

FIGURE 1

Subclones of portions of the 200 kDa protein gene from λ EMBL3 clone 8II and PCR amplification of 5' region

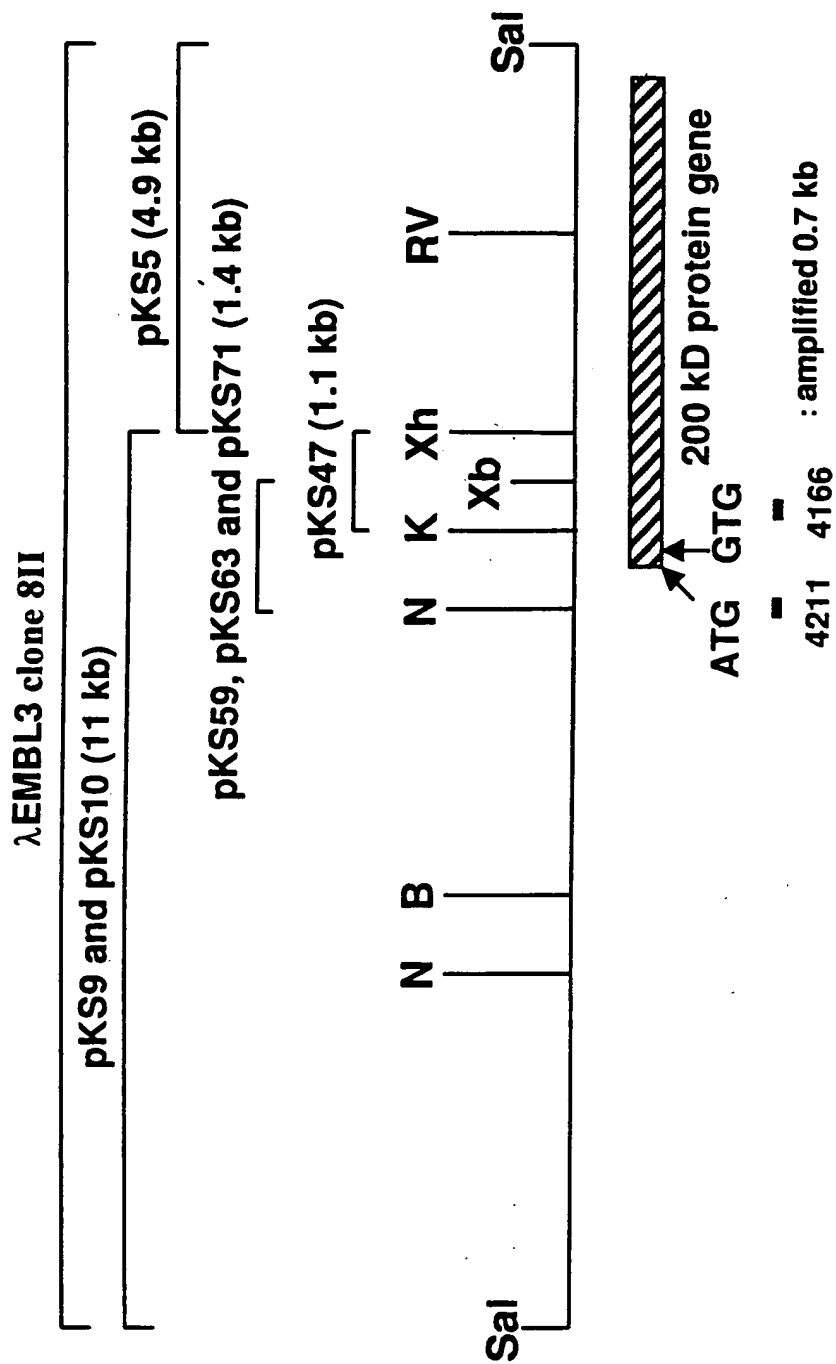


Figure 2. *M. catarrhalis* strain 4223 λ EMBL3 clone 200kDa gene

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ccatggatat gggcaggtgt gctcgcctgc cgtatgatgg cgatgacacc ccatttgccc 60
catatctgta cgatttgaca tgtgatatga tttaacatgt gacatgattt aacattgttt 120
aatactgttg ccattcattac cataatntag taacgcattt agtaacgcat ttgtaaaaat 180
cattgcgccc ctttatgtgt atcatatgaa tagaatatta tgattgtatc tgattattgt 240
atcagaatgg tgatgctata tgatgatgcc tacgagttga tttgggttaa tcactctatg 300
atttgatata ttttgaaact aatctattga cttaaatacac catatggtta taatttagca 360
taatggtagg ctttttgtaa aaatcacatc gcaatattgt tctactgtta ctaccatgct 420
tgaatgacga tccaatacac cagattcatt caagtgatgt gtttgtatac gcaccattta 480
ccctaattat ttcaatcaaa tgcctatgtc agcatgtatc atttttttaa ggtaaaccac 540
catgaatcac atctataaag tcatctttaa caaagccaca ggcacattta tggcagtggc 600
agagtacgcc aaatcccaca gcacggggggg ggggtagctg tgctacaggg caagttggca 660
gtgtatgcac tctgagcttt gcccgatttg ccgcgctcgc tgtcctc gtg atc ggt 716
                               Val Ile Gly
                               1

gca acg ctc agt ggc agt gct tat gct caa aaa aaa gat acc aaa cat 764
Ala Thr Leu Ser Gly Ser Ala Tyr Ala Gln Lys Lys Asp Thr Lys His
      5                10                15

atc gca att ggt gaa caa aac cag cca aga cgc tca ggc act gcc aag 812
Ile Ala Ile Gly Glu Gln Asn Gln Pro Arg Arg Ser Gly Thr Ala Lys
      20                25                30                35

gcg gac ggt gat cga gcc att gct att ggt gaa aat gct aac gca cag 860
Ala Asp Gly Asp Arg Ala Ile Ala Ile Gly Glu Asn Ala Asn Ala Gln
                        40                45                50

ggc ggt caa gcc atc gcc atc ggt agt agt aat aaa act gtc aat gga 908
Gly Gly Gln Ala Ile Ala Ile Gly Ser Ser Asn Lys Thr Val Asn Gly
                        55                60                65

agc agt ttg gat aag ata ggt acc gat gct acg ggt caa gag tcc atc 956
Ser Ser Leu Asp Lys Ile Gly Thr Asp Ala Thr Gly Gln Glu Ser Ile
      70                75                80

gcc atc ggt ggt gat gta aag gct agt ggt gat gcc tcg att gcc atc 1004
Ala Ile Gly Gly Asp Val Lys Ala Ser Gly Asp Ala Ser Ile Ala Ile
      85                90                95

ggc agt gat gac tta cat ttg ctt gat cag cat ggt aat cct aaa cat 1052
Gly Ser Asp Asp Leu His Leu Leu Asp Gln His Gly Asn Pro Lys His
      100                105                110                115

ccg aaa ggt act ctg att aac gat ctt att aac ggc cat gca gta tta 1100
Pro Lys Gly Thr Leu Ile Asn Asp Leu Ile Asn Gly His Ala Val Leu
                        120                125                130

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09361519 "022799

aaa gaa ata cga agc tca aag gat aat gat gta aaa tat aga cgc aca	1148
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acc gca agc gga cac gcc agt act gca gtg gga gcc atg tca tat gca	1196
Thr Ala Ser Gly His Ala Ser Thr Ala Val Gly Ala Met Ser Tyr Ala	
150 155 160	
cag ggt cat ttt tcc aac gcc ttt ggt aca cgg gca aca gct aaa agt	1244
Gln Gly His Phe Ser Asn Ala Phe Gly Thr Arg Ala Thr Ala Lys Ser	
165 170 175	
gcc tat tcc ttg gca gtg ggt ctt gcc gcc aca gcc gag ggc caa tct	1292
Ala Tyr Ser Leu Ala Val Gly Leu Ala Ala Thr Ala Glu Gly Gln Ser	
180 185 190 195	
aca atc gct att ggt tct gat gca aca tct agc tcg ttg gga gcg ata	1340
Thr Ile Ala Ile Gly Ser Asp Ala Thr Ser Ser Ser Leu Gly Ala Ile	
200 205 210	
gcc ctt ggt gca ggt act cgt gct cag cta cag ggc agt att gcc cta	1388
Ala Leu Gly Ala Gly Thr Arg Ala Gln Leu Gln Gly Ser Ile Ala Leu	
215 220 225	
ggt caa ggt tct gtt gtc act cag agt gat aat aat tct aga ccg gcc	1436
Gly Gln Gly Ser Val Val Thr Gln Ser Asp Asn Asn Ser Arg Pro Ala	
230 235 240	
tat aca cca aat acc cag gca cta gac ccc aag ttt caa gcc acc aat	1484
Tyr Thr Pro Asn Thr Gln Ala Leu Asp Pro Lys Phe Gln Ala Thr Asn	
245 250 255	
aat acg aag gcg ggt cca ctt tcc att ggt agt aac tct atc aaa cgt	1532
Asn Thr Lys Ala Gly Pro Leu Ser Ile Gly Ser Asn Ser Ile Lys Arg	
260 265 270 275	
aaa atc atc aat gtc ggt gca ggt gtt aat aaa acc gat gcg gtc aat	1580
Lys Ile Ile Asn Val Gly Ala Gly Val Asn Lys Thr Asp Ala Val Asn	
280 285 290	
gtg gca cag cta gaa gcg gtg gtg aag tgg gct aag gag cgt aga att	1628
Val Ala Gln Leu Glu Ala Val Val Lys Trp Ala Lys Glu Arg Arg Ile	
295 300 305	
act ttt cag ggt gat gat aac agt act gac gta aaa ata ggt ttg gat	1676
Thr Phe Gln Gly Asp Asp Asn Ser Thr Asp Val Lys Ile Gly Leu Asp	
310 315 320	
aat act tta act att aaa ggt ggt gca gag acc aac gca tta acc gat	1724
Asn Thr Leu Thr Ile Lys Gly Gly Ala Glu Thr Asn Ala Leu Thr Asp	
325 330 335	
aat aat atc ggt gtg gta aaa gag gct gat aat agt ggt ctg aaa gtt	1772
Asn Asn Ile Gly Val Val Lys Glu Ala Asp Asn Ser Gly Leu Lys Val	
340 345 350 355	
aaa ctt gct aaa act tta aac aat ctt act gag gtg aat aca act aca	1820
Lys Leu Ala Lys Thr Leu Asn Asn Leu Thr Glu Val Asn Thr Thr Thr	

09361619 "0222" 552222

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Ala	Glu	Leu	Leu	Ser	Asp	Ser	Leu	Thr	Phe	Thr	Gln	Pro	Asn	Thr	Gly														
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Ser	Ala	Leu	Gln	Ser	Phe	Thr	Val	Lys	Glu	Glu	Asp	Asp	Asp	Asp	Ala														
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Ser	Ile	Leu	Lys	Leu	Lys	Gly	Lys	Asn	Gly	Leu	Thr	Val	Ala	Thr	Lys		
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Arg	Asp	Lys	Ile	Gly	Phe	Ala	Gly	Ser	Asp	Gly	Ala	Val	Asp	Thr	Asn		
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Lys	Pro	Tyr	Leu	Asp	Gln	Asp	Lys	Leu	Gln	Val	Gly	Asn	Val	Lys	Ile		
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Thr	Asn	Thr	Gly	Ile	Asn	Ala	Gly	Gly	Lys	Ala	Ile	Thr	Gly	Leu	Ser		
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cca	aca	ctg	cct	agc	att	gcc	gat	caa	agt	agc	cgc	aac	ata	gaa	ctg	2972	
Pro	Thr	Leu	Pro	Ser	Ile	Ala	Asp	Gln	Ser	Ser	Arg	Asn	Ile	Glu	Leu		
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ggc	aat	aca	atc	caa	gac	aaa	gac	aaa	tcc	aac	gct	gcc	agc	att	aat	3020	
Gly	Asn	Thr	Ile	Gln	Asp	Lys	Asp	Lys	Ser	Asn	Ala	Ala	Ser	Ile	Asn		
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gat	ata	tta	aat	aca	ggc	ttt	aac	cta	aaa	aat	aat	aac	aac	ccc	att	3068	
Asp	Ile	Leu	Asn	Thr	Gly	Phe	Asn	Leu	Lys	Asn	Asn	Asn	Asn	Pro	Ile		
				775				780					785				
gac	ttt	gtc	tcc	act	tat	gac	att	gtt	gac	ttt	gcc	aat	ggc	aat	gcc	3116	
Asp	Phe	Val	Ser	Thr	Tyr	Asp	Ile	Val	Asp	Phe	Ala	Asn	Gly	Asn	Ala		
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acc	acc	gcc	aca	gta	acc	cat	gat	acc	gct	aac	aaa	acc	agt	aaa	gtg	3164	
Thr	Thr	Ala	Thr	Val	Thr	His	Asp	Thr	Ala	Asn	Lys	Thr	Ser	Lys	Val		
			805			810					815						
gta	tat	gat	gtg	aat	gtg	gat	gat	aca	acc	att	cat	cta	aca	ggc	act	3212	
Val	Tyr	Asp	Val	Asn	Val	Asp	Asp	Thr	Thr	Ile	His	Leu	Thr	Gly	Thr		
820					825					830					835		

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gat gac aat aaa aaa ctt ggc gtc aaa acc acc aaa ctg aac aaa aca	3260
Asp Asp Asn Lys Lys Leu Gly Val Lys Thr Thr Lys Leu Asn Lys Thr	
840 845 850	
agt gct aat ggt aat aca gca act aac ttt aat gtt aac tct agt gat	3308
Ser Ala Asn Gly Asn Thr Ala Thr Asn Phe Asn Val Asn Ser Ser Asp	
855 860 865	
gaa gat gcc ctt gtt aac gcc aaa gac atc gcc gaa aat cta aac acc	3356
Glu Asp Ala Leu Val Asn Ala Lys Asp Ile Ala Glu Asn Leu Asn Thr	
870 875 880	
cta gcc aag gaa att cac acc acc aaa ggc aca gca gac acc gcc cta	3404
Leu Ala Lys Glu Ile His Thr Thr Lys Gly Thr Ala Asp Thr Ala Leu	
885 890 895	
caa acc ttt acc gtt aaa aag gta gat gaa aat aat aat gct gat gac	3452
Gln Thr Phe Thr Val Lys Lys Val Asp Glu Asn Asn Asn Ala Asp Asp	
900 905 910 915	
gcc aac gcc atc acc gtg ggt caa aag aac gca aat aat caa gtc aac	3500
Ala Asn Ala Ile Thr Val Gly Gln Lys Asn Ala Asn Asn Gln Val Asn	
920 925 930	
acc cta aca ctc aaa ggt gaa aac ggt ctt aat att aaa acc gac aaa	3548
Thr Leu Thr Leu Lys Gly Glu Asn Gly Leu Asn Ile Lys Thr Asp Lys	
935 940 945	
aat ggt acg gtt acc ttt ggc att aac acc aca agc ggt ctt aaa gcc	3596
Asn Gly Thr Val Thr Phe Gly Ile Asn Thr Thr Ser Gly Leu Lys Ala	
950 955 960	
ggc aaa agc acc cta aac gac ggt ggc ttg tct att aaa aac ccc act	3644
Gly Lys Ser Thr Leu Asn Asp Gly Gly Leu Ser Ile Lys Asn Pro Thr	
965 970 975	
ggt agc gaa caa atc caa gtc ggt gct gat ggc gtg aag ttt gcc aag	3692
Gly Ser Glu Gln Ile Gln Val Gly Ala Asp Gly Val Lys Phe Ala Lys	
980 985 990 995	
ggt aat aat aat ggt gtt gta ggt gct ggc att gat ggc aca act cgc	3740
Val Asn Asn Asn Gly Val Val Gly Ala Gly Ile Asp Gly Thr Thr Arg	
1000 1005 1010	
att acc aga gat gaa att ggc ttt act ggg act aat ggc tca ctt gat	3788
Ile Thr Arg Asp Glu Ile Gly Phe Thr Gly Thr Asn Gly Ser Leu Asp	
1015 1020 1025	
aaa agc aaa ccc cac cta agc aaa gac ggc att aac gca ggt ggt aaa	3836
Lys Ser Lys Pro His Leu Ser Lys Asp Gly Ile Asn Ala Gly Gly Lys	
1030 1035 1040	
aag att acc aac att caa tca ggt gag att gcc caa aac agc cat gat	3884
Lys Ile Thr Asn Ile Gln Ser Gly Glu Ile Ala Gln Asn Ser His Asp	
1045 1050 1055	
gct gtg aca ggc ggc aag att tat gat tta aaa acc gaa ctt gaa aac	3932
Ala Val Thr Gly Gly Lys Ile Tyr Asp Leu Lys Thr Glu Leu Glu Asn	
1060 1065 1070 1075	

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tca gta gca gat gaa caa ggt aat aac ttt acg gtt agt aac cct tac	4028
Ser Val Ala Asp Glu Gln Gly Asn Asn Phe Thr Val Ser Asn Pro Tyr	
1095 1100 1105	
tcc agt tat gac acc tca aag acc tct gat gtc atc acc ttt gca ggt	4076
Ser Ser Tyr Asp Thr Ser Lys Thr Ser Asp Val Ile Thr Phe Ala Gly	
1110 1115 1120	
gaa aac ggc att acc acc aag gta aat aaa ggt gtg gtg cgt gtg ggc	4124
Glu Asn Gly Ile Thr Thr Lys Val Asn Lys Gly Val Val Arg Val Gly	
1125 1130 1135	
att gac caa acc aaa ggc tta acc acg cct aag ctg acc gtg ggt aat	4172
Ile Asp Gln Thr Lys Gly Leu Thr Thr Pro Lys Leu Thr Val Gly Asn	
1140 1145 1150 1155	
aat aat ggc aaa ggc att gtc att gac agc caa aat ggt caa aat acc	4220
Asn Asn Gly Lys Gly Ile Val Ile Asp Ser Gln Asn Gly Gln Asn Thr	
1160 1165 1170	
atc aca gga cta agc aac act cta gct aat gtt acc aat gat aaa ggt	4268
Ile Thr Gly Leu Ser Asn Thr Leu Ala Asn Val Thr Asn Asp Lys Gly	
1175 1180 1185	
agc gta cgc acc aca gaa cag ggc aat ata atc aaa gac gaa gac aaa	4316
Ser Val Arg Thr Thr Glu Gln Gly Asn Ile Ile Lys Asp Glu Asp Lys	
1190 1195 1200	
acc cgt gcc gcc agc att gtt gat gtg cta agc gca ggc ttt aac ttg	4364
Thr Arg Ala Ala Ser Ile Val Asp Val Leu Ser Ala Gly Phe Asn Leu	
1205 1210 1215	
caa ggc aat ggt gaa gcg gtt gac ttt gtc tcc act tat gac acc gtc	4412
Gln Gly Asn Gly Glu Ala Val Asp Phe Val Ser Thr Tyr Asp Thr Val	
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aac ttt gcc gat ggc aat gcc acc acc gct aag gtg acc tat gat gac	4460
Asn Phe Ala Asp Gly Asn Ala Thr Thr Ala Lys Val Thr Tyr Asp Asp	
1240 1245 1250	
aca agc aaa acc agt aaa gtg gtc tat gat gtc aat gtg gat gat aca	4508
Thr Ser Lys Thr Ser Lys Val Val Tyr Asp Val Asn Val Asp Asp Thr	
1255 1260 1265	
acc att gaa gtt aaa gat aaa aaa ctt ggc gta aaa acc acc aca ttg	4556
Thr Ile Glu Val Lys Asp Lys Lys Leu Gly Val Lys Thr Thr Thr Leu	
1270 1275 1280	
acc agt act ggc aca ggt gct aat aaa ttt gcc cta agc aat caa gct	4604
Thr Ser Thr Gly Thr Gly Ala Asn Lys Phe Ala Leu Ser Asn Gln Ala	
1285 1290 1295	
act ggc gat gcg ctt gtc aag gcc agt gat atc gtt gct cat cta aac	4652
Thr Gly Asp Ala Leu Val Lys Ala Ser Asp Ile Val Ala His Leu Asn	

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Thr Leu Ser Gly Asp Ile Gln Thr Ala Lys Gly Ala Ser Gln Ala Asn				
1320		1325	1330	
aac tca gca ggc tat gtg gat gct gat ggc aat aag gtc atc tat gac				4748
Asn Ser Ala Gly Tyr Val Asp Ala Asp Gly Asn Lys Val Ile Tyr Asp				
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agt acc gat aac aag tac tat caa gcc aaa aat gat ggc aca gtt gat				4796
Ser Thr Asp Asn Lys Tyr Tyr Gln Ala Lys Asn Asp Gly Thr Val Asp				
1350		1355	1360	
aaa acc aaa gaa gtt gcc aaa gac aaa ctg gtc gcc caa gcc caa acc				4844
Lys Thr Lys Glu Val Ala Lys Asp Lys Leu Val Ala Gln Ala Gln Thr				
1365		1370	1375	
cca gat ggc aca ttg gct caa atg aat gtc aaa tca gtc att aac aaa				4892
Pro Asp Gly Thr Leu Ala Gln Met Asn Val Lys Ser Val Ile Asn Lys				
1380		1385	1390	1395
gaa caa gta aat gat gcc aat aaa aag caa ggc atc aat gaa gac aac				4940
Glu Gln Val Asn Asp Ala Asn Lys Lys Gln Gly Ile Asn Glu Asp Asn				
1400		1405	1410	
gcc ttt gtt aaa gga ctt gaa aaa gcc gct tct gat aac aaa acc aaa				4988
Ala Phe Val Lys Gly Leu Glu Lys Ala Ala Ser Asp Asn Lys Thr Lys				
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aac gcc gca gta act gtg ggt gat tta aat gcc gtt gcc caa aca ccg				5036
Asn Ala Ala Val Thr Val Gly Asp Leu Asn Ala Val Ala Gln Thr Pro				
1430		1435	1440	
ctg acc ttt gca ggg gat aca ggc aca acg gct aaa aaa ctg ggc gag				5084
Leu Thr Phe Ala Gly Asp Thr Gly Thr Thr Ala Lys Lys Leu Gly Glu				
1445		1450	1455	
act ttg acc atc aaa ggt ggg caa aca gac acc aat aag cta acc gat				5132
Thr Leu Thr Ile Lys Gly Gly Gln Thr Asp Thr Asn Lys Leu Thr Asp				
1460		1465	1470	1475
aat aac atc ggt gtg gta gca ggt act gat ggc ttc act gtc aaa ctt				5180
Asn Asn Ile Gly Val Val Ala Gly Thr Asp Gly Phe Thr Val Lys Leu				
1480		1485	1490	
gcc aaa gac cta acc aat ctt aac agc gtt aat gca ggt ggc acc aaa				5228
Ala Lys Asp Leu Thr Asn Leu Asn Ser Val Asn Ala Gly Gly Thr Lys				
1495		1500	1505	
att gat gac aaa ggc gtg tct ttt gta gac tca agc ggt caa gcc aaa				5276
Ile Asp Asp Lys Gly Val Ser Phe Val Asp Ser Ser Gly Gln Ala Lys				
1510		1515	1520	
gca aac acc cct gtg cta agt gcc aat ggg ctg gac ctg ggt ggc aag				5324
Ala Asn Thr Pro Val Leu Ser Ala Asn Gly Leu Asp Leu Gly Gly Lys				
1525		1530	1535	
gtc atc agt aat gtg ggc aaa ggc aca aaa gat acc gac gct gcc aat				5372

Val Ile Ser Asn Val Gly Lys Gly Thr Lys Asp Thr Asp Ala Ala Asn	
1540 1545 1550 1555	
gta caa cag tta aac gaa gta cgc aac ttg ttg ggt ctt ggt aat gct	5420
Val Gln Gln Leu Asn Glu Val Arg Asn Leu Leu Gly Leu Gly Asn Ala	
1560 1565 1570	
ggt aat gat aac gct gac ggc aat cag gta aac att gcc gac atc aaa	5468
Gly Asn Asp Asn Ala Asp Gly Asn Gln Val Asn Ile Ala Asp Ile Lys	
1575 1580 1585	
aaa gac cca aat tca ggt tca tca tct aac cgc act gtc atc aaa gca	5516
Lys Asp Pro Asn Ser Gly Ser Ser Ser Asn Arg Thr Val Ile Lys Ala	
1590 1595 1600	
ggc acg gta ctt ggc ggt aaa ggt aat aac gat acc gaa aaa ctt gcc	5564
Gly Thr Val Leu Gly Gly Lys Gly Asn Asn Asp Thr Glu Lys Leu Ala	
1605 1610 1615	
act ggt ggt ata caa gtg ggc gtg gat aaa gac ggc aac gct aac ggc	5612
Thr Gly Gly Ile Gln Val Gly Val Asp Lys Asp Gly Asn Ala Asn Gly	
1620 1625 1630 1635	
gat tta agc aat gtt tgg gtc aaa acc caa aaa gat ggc agc aaa aaa	5660
Asp Leu Ser Asn Val Trp Val Lys Thr Gln Lys Asp Gly Ser Lys Lys	
1640 1645 1650	
gcc ctg ctc gcc act tat aac gcc gca ggt cag acc aac tat ttg acc	5708
Ala Leu Leu Ala Thr Tyr Asn Ala Ala Gly Gln Thr Asn Tyr Leu Thr	
1655 1660 1665	
aac aac ccc gca gaa gcc att gac aga ata aat gaa caa ggt atc cgc	5756
Asn Asn Pro Ala Glu Ala Ile Asp Arg Ile Asn Glu Gln Gly Ile Arg	
1670 1675 1680	
ttc ttc cat gtc aac gat ggc aat caa gag cct gtg gta caa ggg cgt	5804
Phe Phe His Val Asn Asp Gly Asn Gln Glu Pro Val Val Gln Gly Arg	
1685 1690 1695	
aac ggc att gac tca agt gcc tca ggc aag cac tca gtg gcg ata ggt	5852
Asn Gly Ile Asp Ser Ser Ala Ser Gly Lys His Ser Val Ala Ile Gly	
1700 1705 1710 1715	
ttc cag gcc aag gca gat ggt gaa gcc gcc gtt gcc ata ggc aga caa	5900
Phe Gln Ala Lys Ala Asp Gly Glu Ala Ala Val Ala Ile Gly Arg Gln	
1720 1725 1730	
acc caa gca ggc aac caa tcc atc gcc atc ggt gat aac gca caa gcc	5948
Thr Gln Ala Gly Asn Gln Ser Ile Ala Ile Gly Asp Asn Ala Gln Ala	
1735 1740 1745	
acg ggc gat caa tcc atc gcc atc ggt aca ggc aat gtg gta gca ggt	5996
Thr Gly Asp Gln Ser Ile Ala Ile Gly Thr Gly Asn Val Val Ala Gly	
1750 1755 1760	
aag cac tct ggt gcc atc ggc gac cca agc act gtt aag gct gat aac	6044
Lys His Ser Gly Ala Ile Gly Asp Pro Ser Thr Val Lys Ala Asp Asn	
1765 1770 1775	

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agt tac agt gtg ggt aat aac aac cag ttt acc gat gcc act caa acc	6092
Ser Tyr Ser Val Gly Asn Asn Asn Gln Phe Thr Asp Ala Thr Gln Thr	
1780 1785 1790 1795	
gat gtc ttt ggt gtg ggc aat aac atc acc gtg acc gaa agt aac tcg	6140
Asp Val Phe Gly Val Gly Asn Asn Ile Thr Val Thr Glu Ser Asn Ser	
1800 1805 1810	
gtt gcc tta ggt tca aac tct gcc atc agt gca ggc aca cac gca ggc	6188
Val Ala Leu Gly Ser Asn Ser Ala Ile Ser Ala Gly Thr His Ala Gly	
1815 1820 1825	
aca caa gcc aaa aaa tct gac ggc aca gca ggt aca acc acc aca gca	6236
Thr Gln Ala Lys Lys Ser Asp Gly Thr Ala Gly Thr Thr Thr Ala	
1830 1835 1840	
ggg gca acc ggt acg gtt aaa ggc ttt gct gga caa acg gcg gtt ggt	6284
Gly Ala Thr Gly Thr Val Lys Gly Phe Ala Gly Gln Thr Ala Val Gly	
1845 1850 1855	
gcg gtc tcc gtg ggt gcc tca ggt gct gaa cgc cgt atc caa aat gtg	6332
Ala Val Ser Val Gly Ala Ser Gly Ala Glu Arg Arg Ile Gln Asn Val	
1860 1865 1870 1875	
gca gca ggt gag gtc agt gcc acc agc acc gat gcg gtc aat ggt agc	6380
Ala Ala Gly Glu Val Ser Ala Thr Ser Thr Asp Ala Val Asn Gly Ser	
1880 1885 1890	
cag ttg tac aaa gcc acc caa agc att gcc aac gca acc aat gag ctt	6428
Gln Leu Tyr Lys Ala Thr Gln Ser Ile Ala Asn Ala Thr Asn Glu Leu	
1895 1900 1905	
gac cat cgt atc cac caa aac gaa aat aag gcc aat gca ggg att tca	6476
Asp His Arg Ile His Gln Asn Glu Asn Lys Ala Asn Ala Gly Ile Ser	
1910 1915 1920	
tca gcg atg gcg atg gcg tcc atg cca caa gcc tac att cct ggc aga	6524
Ser Ala Met Ala Met Ala Ser Met Pro Gln Ala Tyr Ile Pro Gly Arg	
1925 1930 1935	
tcc atg gtt acc ggg ggt att gcc acc cac aac ggt caa ggt gcg gtg	6572
Ser Met Val Thr Gly Gly Ile Ala Thr His Asn Gly Gln Gly Ala Val	
1940 1945 1950 1955	
gca gtg gga ctg tcg aag ctg tcg gat aat ggt caa tgg gta ttt aaa	6620
Ala Val Gly Leu Ser Lys Leu Ser Asp Asn Gly Gln Trp Val Phe Lys	
1960 1965 1970	
atc aat ggt tca gcc gat acc caa ggc cat gta ggg gcg gca gtt ggt	6668
Ile Asn Gly Ser Ala Asp Thr Gln Gly His Val Gly Ala Ala Val Gly	
1975 1980 1985	
gca ggt ttt cac ttt taagccataa atcgcaagat ttacttaaa aatcaatctc	6723
Ala Gly Phe His Phe	
1990	
accatagttg tataaaacag catcagcatc agtcatatta ctgatgctga tgttttttat	6783
cacttaaacc attttaccgc tcaagtgatt ctctttcacc atgaccaa atcgccattgat	6843

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cataggtaaa cttattgagt aaattttatc aatgtagttg ttagatatgg ttaaaattgt 6903
gccattgacc aaaaaatgac cgatttatcc cgaaaatttc tgattatgat ccgttgacct 6963
gcaggtcgac 6973

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Figure 3. *M. catarrhalis* strain 4223 genomic 200kDa gene.

ccatggatat gggcaggtgt gctcgctgc cgtatgatgg cgatgacacc ccatttgccc 60
catatctgta cgatttgaca tgtgatatga tttaacatgt gacatgattt aacattgttt 120
aatactgttg ccattcattac cataatntag taacgcattt agtaacgcat ttgtaaaaat 180
cattgcgccc ctttatgtgt atcatatgaa tagaatatta tgattgtatc tgattattgt 240
atcagaatgg tgatgctata tgatgatgcc tacgagttga tttgggttaa tcaactctatg 300
atttgatata ttttgaaact aatctattga cttaaatacac catatgggta taatttagca 360
taatggtagg ctttttgtaa aaatcacatc gcaatattgt tctactgtta ctaccatgct 420
tgaatgacga tcccaatacac cagattcatt caagtgatgt gtttgatac gcaccattta 480
ccctaattat ttcaatcaaa tgcctatgtc agcatgtatc atttttttaa ggtaaaccac 540
c atg aat cac atc tat aaa gtc atc ttt aac aaa gcc aca ggc aca ttt 589
Met Asn His Ile Tyr Lys Val Ile Phe Asn Lys Ala Thr Gly Thr Phe
1 5 10 15
atg gca gtg gca gag tac gcc aaa tcc cac agc acg ggg ggg ggt agc 637
Met Ala Val Ala Glu Tyr Ala Lys Ser His Ser Thr Gly Gly Gly Ser
20 25 30
tgt gct aca ggg caa gtt ggc agt gta tgc act ctg agc ttt gcc cgt 685
Cys Ala Thr Gly Gln Val Gly Ser Val Cys Thr Leu Ser Phe Ala Arg
35 40 45
att gcc gcg ctc gct gtc ctc gtg atc ggt gca acg ctc agt ggc agt 733
Ile Ala Ala Leu Ala Val Leu Val Ile Gly Ala Thr Leu Ser Gly Ser
50 55 60
gct tat gct caa aaa aaa gat acc aaa cat atc gca att ggt gaa caa 781
Ala Tyr Ala Gln Lys Lys Asp Thr Lys His Ile Ala Ile Gly Glu Gln
65 70 75 80
aac cag cca aga cgc tca ggc act gcc aag gcg gac ggt gat cga gcc 829
Asn Gln Pro Arg Arg Ser Gly Thr Ala Lys Ala Asp Gly Asp Arg Ala
85 90 95
att gct att ggt gaa aat gct aac gca cag ggc ggt caa gcc atc gcc 877
Ile Ala Ile Gly Glu Asn Ala Asn Ala Gln Gly Gly Gln Ala Ile Ala
100 105 110
atc ggt agt agt aat aaa act gtc aat gga agc agt ttg gat aag ata 925
Ile Gly Ser Ser Asn Lys Thr Val Asn Gly Ser Ser Leu Asp Lys Ile
115 120 125
ggg acc gat gct acg ggt caa gag tcc atc gcc atc ggt ggt gat gta 973
Gly Thr Asp Ala Thr Gly Gln Glu Ser Ile Ala Ile Gly Gly Asp Val
130 135 140
aag gct agt ggt gat gcc tcg att gcc atc ggt agt gat gac tta cat 1021
Lys Ala Ser Gly Asp Ala Ser Ile Ala Ile Gly Ser Asp Asp Leu His

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145		150		155		160	
ttg ctt gat cag cat ggt aat cct aaa cat ccg aaa ggt act ctg att	1069						
Leu Leu Asp Gln His Gly Asn Pro Lys His Pro Lys Gly Thr Leu Ile							
		165		170		175	
aac gat ctt att aac ggc cat gca gta tta aaa gaa ata cga agc tca	1117						
Asn Asp Leu Ile Asn Gly His Ala Val Leu Lys Glu Ile Arg Ser Ser		180		185		190	
aag gat aat gat gta aaa tat aga cgc aca acc gca agc gga cac gcc	1165						
Lys Asp Asn Asp Val Lys Tyr Arg Arg Thr Thr Ala Ser Gly His Ala		195		200		205	
agt act gca gtg gga gcc atg tca tat gca cag ggt cat ttt tcc aac	1213						
Ser Thr Ala Val Gly Ala Met Ser Tyr Ala Gln Gly His Phe Ser Asn		210		215		220	
gcc ttt ggt aca cgg gca aca gct aaa agt gcc tat tcc ttg gca gtg	1261						
Ala Phe Gly Thr Arg Ala Thr Ala Lys Ser Ala Tyr Ser Leu Ala Val		225		230		235	240
ggg ctt gcc gcc aca gcc gag ggc caa tct aca atc gct att ggt tct	1309						
Gly Leu Ala Ala Thr Ala Glu Gly Gln Ser Thr Thr Ile Ala Ile Gly Ser		245		250		255	
gat gca aca tct agc tcg ttg gga gcg ata gcc ctt ggt gca ggt act	1357						
Asp Ala Thr Ser Ser Ser Leu Gly Ala Ile Ala Leu Gly Ala Gly Thr		260		265		270	
cgt gct cag cta cag ggc agt att gcc cta ggt caa ggt tct gtt gtc	1405						
Arg Ala Gln Leu Gln Gly Ser Ile Ala Leu Gly Gln Gly Ser Val Val		275		280		285	
act cag agt gat aat aat tct aga ccg gcc tat aca cca aat acc cag	1453						
Thr Gln Ser Asp Asn Asn Ser Arg Pro Ala Tyr Thr Pro Asn Thr Gln		290		295		300	
gca cta gac ccc aag ttt caa gcc acc aat aat acg aag gcg ggt cca	1501						
Ala Leu Asp Pro Lys Phe Gln Ala Thr Asn Asn Thr Lys Ala Gly Pro		305		310		315	320
ctt tcc att ggt agt aac tct atc aaa cgt aaa atc atc aat gtc ggt	1549						
Leu Ser Ile Gly Ser Asn Ser Ile Lys Arg Lys Ile Ile Asn Val Gly		325		330		335	
gca ggt gtt aat aaa acc gat gcg gtc aat gtg gca cag cta gaa gcg	1597						
Ala Gly Val Asn Lys Thr Asp Ala Val Asn Val Ala Gln Leu Glu Ala		340		345		350	
gtg gtg aag tgg gct aag gag cgt aga att act ttt cag ggt gat gat	1645						
Val Val Lys Trp Ala Lys Glu Arg Arg Ile Thr Phe Gln Gly Asp Asp		355		360		365	
aac agt act gac gta aaa ata ggt ttg gat aat act tta act att aaa	1693						
Asn Ser Thr Asp Val Lys Ile Gly Leu Asp Asn Thr Leu Thr Ile Lys		370		375		380	
ggg ggt gca gag acc aac gca tta acc gat aat aat atc ggt gtg gta	1741						

Gly 385	Gly	Ala	Glu	Thr	Asn 390	Ala	Leu	Thr	Asp	Asn 395	Asn	Ile	Gly	Val	Val 400	
aaa Lys	gag Glu	gct Ala	gat Asp	aat Asn	agt Ser	ggg Gly	ctg Leu	aaa Lys	gtt Val	aaa Lys	ctt Leu	gct Ala	aaa Lys	act Thr	tta Leu	1789
aac Asn	aat Asn	ctt Leu	act Thr	gag Glu	gtg Val	aat Asn	aca Thr	act Thr	aca Thr	tta Leu	aat Asn	gcc Ala	aca Thr	acc Thr	aca Thr	1837
gtt Val	aag Lys	gta Val	ggg Gly	agt Ser	agt Ser	agt Ser	agt Ser	act Thr	aca Thr	gct Ala	gaa Glu	tta Leu	ttg Leu	agt Ser	gat Asp	1885
agt Ser	tta Leu	acc Thr	ttt Phe	acc Thr	cag Gln	ccc Pro	aat Asn	aca Thr	ggc Gly	agt Ser	caa Gln	agc Ser	aca Thr	agc Ser	aaa Lys	1933
acc Thr	gtc Val	tat Tyr	ggc Gly	gtt Val	aat Asn	ggg Gly	gtg Val	aag Lys	ttt Phe	act Thr	aat Asn	aat Asn	gca Ala	gaa Glu	aca Thr	1981
aca Thr	gca Ala	gca Ala	atc Ile	ggc Gly	act Thr	act Thr	cgt Arg	att Ile	acc Thr	aga Arg	gat Asp	aaa Lys	att Ile	ggc Gly	ttt Phe	2029
gct Ala	cga Arg	gat Asp	ggg Gly	gat Asp	gtt Val	gat Asp	gaa Glu	aaa Lys	caa Gln	gca Ala	cca Pro	tat Tyr	ttg Leu	gat Asp	aaa Lys	2077
aaa Lys	caa Gln	ctt Leu	aaa Lys	gtg Val	ggg Gly	agt Ser	gtt Val	gca Ala	att Ile	acc Thr	ata Ile	gac Asp	aat Asn	ggc Gly	att Ile	2125
gat Asp	gca Ala	ggg Gly	aat Asn	aaa Lys	aag Lys	atc Ile	agt Ser	aat Asn	ctt Leu	gcc Ala	aaa Lys	ggg Gly	agc Ser	agt Ser	gct Ala	2173
aac Asn	gat Asp	gca Ala	gtt Val	acc Thr	atc Ile	gaa Glu	cag Gln	ctc Leu	aaa Lys	gcc Ala	gcc Ala	aag Lys	cct Pro	act Thr	tta Leu	2221
aac Asn	gca Ala	ggc Gly	gct Ala	ggc Gly	atc Ile	agt Ser	gtc Val	aca Thr	cct Pro	act Thr	gaa Glu	ata Ile	tca Ser	gtt Val	gat Asp	2269
gct Ala	aag Lys	agt Ser	ggc Gly	aat Asn	gtt Val	acc Thr	gcc Ala	cca Pro	act Thr	tac Tyr	aac Asn	att Ile	ggc Gly	gtg Val	aaa Lys	2317
acc Thr	acc Thr	gag Glu	ctt Leu	aac Asn	agt Ser	gat Asp	ggc Gly	act Thr	agt Ser	gat Asp	aaa Lys	ttt Phe	agt Ser	gtt Val	aag Lys	2365
ggg Gly	agt Ser	ggg Gly	acg Thr	aac Asn	aat Asn	agc Ser	tta Leu	gtt Val	acc Thr	gcc Ala	gaa Glu	cat His	ttg Leu	gca Ala	agc Ser	2413

tat cta aat gaa gtc aat cga acg gct gac agt gct cta caa agc ttt	2461
Tyr Leu Asn Glu Val Asn Arg Thr Ala Asp Ser Ala Leu Gln Ser Phe	
625 630 635 640	
acc gtt aaa gaa gaa gac gat gat gac gcc aac gct atc acc gtg gct	2509
Thr Val Lys Glu Glu Asp Asp Asp Ala Asn Ala Ile Thr Val Ala	
645 650 655	
aaa gat acg aca aaa aat gcc ggc gca gtc agc atc tta aaa ctc aaa	2557
Lys Asp Thr Thr Lys Asn Ala Gly Ala Val Ser Ile Leu Lys Leu Lys	
660 665 670	
ggg aaa aac ggt cta acg gtt gct acc aaa aaa gat ggt acg gtt acc	2605
Gly Lys Asn Gly Leu Thr Val Ala Thr Lys Lys Asp Gly Thr Val Thr	
675 680 685	
ttt ggg ctt agc caa gat agc ggt ctg acc att ggc aaa agc acc cta	2653
Phe Gly Leu Ser Gln Asp Ser Gly Leu Thr Ile Gly Lys Ser Thr Leu	
690 695 700	
aac aac gat ggc ttg act gtt aaa gat acc aac gaa caa atc caa gtc	2701
Asn Asn Asp Gly Leu Thr Val Lys Asp Thr Asn Glu Gln Ile Gln Val	
705 710 715 720	
ggg gct aat ggc att aaa ttt act aat gtg aat ggt agt aat cca ggt	2749
Gly Ala Asn Gly Ile Lys Phe Thr Asn Val Asn Gly Ser Asn Pro Gly	
725 730 735	
act ggc att gca aat acc gct cgc att acc aga gat aaa att ggc ttt	2797
Thr Gly Ile Ala Asn Thr Ala Arg Ile Thr Arg Asp Lys Ile Gly Phe	
740 745 750	
gct ggt tct gat ggt gca gtt gat aca aac aaa cct tat ctt gat caa	2845
Ala Gly Ser Asp Gly Ala Val Asp Thr Asn Lys Pro Tyr Leu Asp Gln	
755 760 765	
gac aag cta caa gtt ggc aat gtt aag att acc aac act ggc att aac	2893
Asp Lys Leu Gln Val Gly Asn Val Lys Ile Thr Asn Thr Gly Ile Asn	
770 775 780	
gca ggt ggt aaa gcc atc aca ggg ctg tcc cca aca ctg cct agc att	2941
Ala Gly Gly Lys Ala Ile Thr Gly Leu Ser Pro Thr Leu Pro Ser Ile	
785 790 795 800	
gcc gat caa agt agc cgc aac ata gaa ctg ggc aat aca atc caa gac	2989
Ala Asp Gln Ser Ser Arg Asn Ile Glu Leu Gly Asn Thr Ile Gln Asp	
805 810 815	
aaa gac aaa tcc aac gct gcc agc att aat gat ata tta aat aca ggc	3037
Lys Asp Lys Ser Asn Ala Ala Ser Ile Asn Asp Ile Leu Asn Thr Gly	
820 825 830	
ttt aac cta aaa aat aat aac aac ccc att gac ttt gtc tcc act tat	3085
Phe Asn Leu Lys Asn Asn Asn Asn Pro Ile Asp Phe Val Ser Thr Tyr	
835 840 845	
gac att gtt gac ttt gcc aat ggc aat gcc acc acc gcc aca gta acc	3133
Asp Ile Val Asp Phe Ala Asn Gly Asn Ala Thr Thr Ala Thr Val Thr	
850 855 860	

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cat gat acc gct aac aaa acc agt aaa gtg gta tat gat gtg aat gtg	3181
His Asp Thr Ala Asn Lys Thr Ser Lys Val Val Tyr Asp Val Asn Val	
865 870 875 880	
gat gat aca acc att cat cta aca ggc act gat gac aat aaa aaa ctt	3229
Asp Asp Thr Thr Ile His Leu Thr Gly Thr Asp Asp Asn Lys Lys Leu	
885 890 895	
ggc gtc aaa acc acc aaa ctg aac aaa aca agt gct aat ggt aat aca	3277
Gly Val Lys Thr Thr Lys Leu Asn Lys Thr Ser Ala Asn Gly Asn Thr	
900 905 910	
gca act aac ttt aat gtt aac tct agt gat gaa gat gcc ctt gtt aac	3325
Ala Thr Asn Phe Asn Val Asn Ser Ser Asp Glu Asp Ala Leu Val Asn	
915 920 925	
gcc aaa gac atc gcc gaa aat cta aac acc cta gcc aag gaa att cac	3373
Ala Lys Asp Ile Ala Glu Asn Leu Asn Thr Leu Ala Lys Glu Ile His	
930 935 940	
acc acc aaa ggc aca gca gac acc gcc cta caa acc ttt acc gtt aaa	3421
Thr Thr Lys Gly Thr Ala Asp Thr Ala Leu Gln Thr Phe Thr Val Lys	
945 950 955 960	
aag gta gat gaa aat aat aat gct gat gac gcc aac gcc atc acc gtg	3469
Lys Val Asp Glu Asn Asn Asn Ala Asp Asp Ala Asn Ala Ile Thr Val	
965 970 975	
ggt caa aag aac gca aat aat caa gtc aac acc cta aca ctc aaa ggt	3517
Gly Gln Lys Asn Ala Asn Asn Gln Val Asn Thr Leu Thr Leu Lys Gly	
980 985 990	
gaa aac ggt ctt aat att aaa acc gac aaa aat ggt acg gtt acc ttt	3565
Glu Asn Gly Leu Asn Ile Lys Thr Asp Lys Asn Gly Thr Val Thr Phe	
995 1000 1005	
ggc att aac acc aca agc ggt ctt aaa gcc ggc aaa agc acc cta aac	3613
Gly Ile Asn Thr Thr Ser Gly Leu Lys Ala Gly Lys Ser Thr Leu Asn	
1010 1015 1020	
gac ggt ggc ttg tct att aaa aac ccc act ggt agc gaa caa atc caa	3661
Asp Gly Gly Leu Ser Ile Lys Asn Pro Thr Gly Ser Glu Gln Ile Gln	
1025 1030 1035 1040	
gtc ggt gct gat ggc gtg aag ttt gcc aag gtt aat aat aat ggt gtt	3709
Val Gly Ala Asp Gly Val Lys Phe Ala Lys Val Asn Asn Asn Gly Val	
1045 1050 1055	
gta ggt gct ggc att gat ggc aca act cgc att acc aga gat gaa att	3757
Val Gly Ala Gly Ile Asp Gly Thr Thr Arg Ile Thr Arg Asp Glu Ile	
1060 1065 1070	
ggc ttt act ggg act aat ggc tca ctt gat aaa agc aaa ccc cac cta	3805
Gly Phe Thr Gly Thr Asn Gly Ser Leu Asp Lys Ser Lys Pro His Leu	
1075 1080 1085	
agc aaa gac ggc att aac gca ggt ggt aaa aag att acc aac att caa	3853
Ser Lys Asp Gly Ile Asn Ala Gly Gly Lys Lys Ile Thr Asn Ile Gln	

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1090	1095	1100	
tca ggt gag att gcc caa aac agc cat gat gct gtg aca ggc ggc aag Ser Gly Glu Ile Ala Gln Asn Ser His Asp Ala Val Thr Gly Gly Lys 1105 1110 1115 1120			3901
att tat gat tta aaa acc gaa ctt gaa aac aaa atc agc agt act gcc Ile Tyr Asp Leu Lys Thr Glu Leu Glu Asn Lys Ile Ser Ser Thr Ala 1125 1130 1135			3949
aaa aca gca caa aac tca tta cac gaa ttc tca gta gca gat gaa caa Lys Thr Ala Gln Asn Ser Leu His Glu Phe Ser Val Ala Asp Glu Gln 1140 1145 1150			3997
ggc aat aac ttt acg gtt agt aac cct tac tcc agt tat gac acc tca Gly Asn Asn Phe Thr Val Ser Asn Pro Tyr Ser Ser Tyr Asp Thr Ser 1155 1160 1165			4045
aag acc tct gat gtc atc acc ttt gca ggt gaa aac ggc att acc acc Lys Thr Ser Asp Val Ile Thr Phe Ala Gly Glu Asn Gly Ile Thr Thr 1170 1175 1180			4093
aag gta aat aaa ggt gtg gtg cgt gtg ggc att gac caa acc aaa ggc Lys Val Asn Lys Gly Val Val Arg Val Gly Ile Asp Gln Thr Lys Gly 1185 1190 1195 1200			4141
tta acc acg cct aag ctg acc gtg ggt aat aat aat ggc aaa ggc att Leu Thr Thr Pro Lys Leu Thr Val Gly Asn Asn Asn Gly Lys Gly Ile 1205 1210 1215			4189
gtc att gac agc caa aat ggt caa aat acc atc aca gga cta agc aac Val Ile Asp Ser Gln Asn Gly Gln Asn Thr Ile Thr Gly Leu Ser Asn 1220 1225 1230			4237
act cta gct aat gtt acc aat gat aaa ggt agc gta cgc acc aca gaa Thr Leu Ala Asn Val Thr Asn Asp Lys Gly Ser Val Arg Thr Thr Glu 1235 1240 1245			4285
cag ggc aat ata atc aaa gac gaa gac aaa acc cgt gcc gcc agc att Gln Gly Asn Ile Ile Lys Asp Glu Asp Lys Thr Arg Ala Ala Ser Ile 1250 1255 1260			4333
gtt gat gtg cta agc gca ggc ttt aac ttg caa ggc aat ggt gaa gcg Val Asp Val Leu Ser Ala Gly Phe Asn Leu Gln Gly Asn Gly Glu Ala 1265 1270 1275 1280			4381
gtt gac ttt gtc tcc act tat gac acc gtc aac ttt gcc gat ggc aat Val Asp Phe Val Ser Thr Tyr Asp Thr Val Asn Phe Ala Asp Gly Asn 1285 1290 1295			4429
gcc acc acc gct aag gtg acc tat gat gac aca agc aaa acc agt aaa Ala Thr Thr Ala Lys Val Thr Tyr Asp Asp Thr Ser Lys Thr Ser Lys 1300 1305 1310			4477
gtg gtc tat gat gtc aat gtg gat gat aca acc att gaa gtt aaa gat Val Val Tyr Asp Val Asn Val Asp Asp Thr Thr Ile Glu Val Lys Asp 1315 1320 1325			4525
aaa aaa ctt ggc gta aaa acc acc aca ttg acc agt act ggc aca ggt			4573

Lys Lys Leu Gly Val Lys Thr Thr Thr Leu Thr Ser Thr Gly Thr Gly	
1330 1335 1340	
gct aat aaa ttt gcc cta agc aat caa gct act ggc gat gcg ctt gtc	4621
Ala Asn Lys Phe Ala Leu Ser Asn Gln Ala Thr Gly Asp Ala Leu Val	
1345 1350 1355 1360	
aag gcc agt gat atc gtt gct cat cta aac acc tta tct ggc gac atc	4669
Lys Ala Ser Asp Ile Val Ala His Leu Asn Thr Leu Ser Gly Asp Ile	
1365 1370 1375	
caa act gcc aaa ggg gca agc caa gcg aac aac tca gca ggc tat gtg	4717
Gln Thr Ala Lys Gly Ala Ser Gln Ala Asn Asn Ser Ala Gly Tyr Val	
1380 1385 1390	
gat gct gat ggc aat aag gtc atc tat gac agt acc gat aac aag tac	4765
Asp Ala Asp Gly Asn Lys Val Ile Tyr Asp Ser Thr Asp Asn Lys Tyr	
1395 1400 1405	
tat caa gcc aaa aat gat ggc aca gtt gat aaa acc aaa gaa gtt gcc	4813
Tyr Gln Ala Lys Asn Asp Gly Thr Val Asp Lys Thr Lys Glu Val Ala	
1410 1415 1420	
aaa gac aaa ctg gtc gcc caa gcc caa acc cca gat ggc aca ttg gct	4861
Lys Asp Lys Leu Val Ala Gln Ala Gln Thr Pro Asp Gly Thr Leu Ala	
1425 1430 1435 1440	
caa atg aat gtc aaa tca gtc att aac aaa gaa caa gta aat gat gcc	4909
Gln Met Asn Val Lys Ser Val Ile Asn Lys Glu Gln Val Asn Asp Ala	
1445 1450 1455	
aat aaa aag caa ggc atc aat gaa gac aac gcc ttt gtt aaa gga ctt	4957
Asn Lys Lys Gln Gly Ile Asn Glu Asp Asn Ala Phe Val Lys Gly Leu	
1460 1465 1470	
gaa aaa gcc gct tct gat aac aaa acc aaa aac gcc gca gta act gtg	5005
Glu Lys Ala Ala Ser Asp Asn Lys Thr Lys Asn Ala Ala Val Thr Val	
1475 1480 1485	
ggg gat tta aat gcc gtt gcc caa aca ccg ctg acc ttt gca ggg gat	5053
Gly Asp Leu Asn Ala Val Ala Gln Thr Pro Leu Thr Phe Ala Gly Asp	
1490 1495 1500	
aca ggc aca acg gct aaa aaa ctg ggc gag act ttg acc atc aaa ggt	5101
Thr Gly Thr Thr Ala Lys Lys Leu Gly Glu Thr Leu Thr Ile Lys Gly	
1505 1510 1515 1520	
ggg caa aca gac acc aat aag cta acc gat aat aac atc ggt gtg gta	5149
Gly Gln Thr Asp Thr Asn Lys Leu Thr Asp Asn Asn Ile Gly Val Val	
1525 1530 1535	
gca ggt act gat ggc ttc act gtc aaa ctt gcc aaa gac cta acc aat	5197
Ala Gly Thr Asp Gly Phe Thr Val Lys Leu Ala Lys Asp Leu Thr Asn	
1540 1545 1550	
ctt aac agc gtt aat gca ggt ggc acc aaa att gat gac aaa ggc gtg	5245
Leu Asn Ser Val Asn Ala Gly Gly Thr Lys Ile Asp Asp Lys Gly Val	
1555 1560 1565	

tct ttt gta gac tca agc ggt caa gcc aaa gca aac acc cct gtg cta	5293
Ser Phe Val Asp Ser Ser Gly Gln Ala Lys Ala Asn Thr Pro Val Leu	
1570 1575 1580	
agt gcc aat ggg ctg gac ctg ggt ggc aag gtc atc agt aat gtg ggc	5341
Ser Ala Asn Gly Leu Asp Leu Gly Gly Lys Val Ile Ser Asn Val Gly	
1585 1590 1595 1600	
aaa ggc aca aaa gat acc gac gct gcc aat gta caa cag tta aac gaa	5389
Lys Gly Thr Lys Asp Thr Asp Ala Ala Asn Val Gln Gln Leu Asn Glu	
1605 1610 1615	
gta cgc aac ttg ttg ggt ctt ggt aat gct ggt aat gat aac gct gac	5437
Val Arg Asn Leu Leu Gly Leu Gly Asn Ala Gly Asn Asp Asn Ala Asp	
1620 1625 1630	
ggc aat cag gta aac att gcc gac atc aaa aaa gac cca aat tca ggt	5485
Gly Asn Gln Val Asn Ile Ala Asp Ile Lys Lys Asp Pro Asn Ser Gly	
1635 1640 1645	
tca tca tct aac cgc act gtc atc aaa gca ggc acg gta ctt ggc ggt	5533
Ser Ser Ser Asn Arg Thr Val Ile Lys Ala Gly Thr Val Leu Gly Gly	
1650 1655 1660	
aaa ggt aat aac gat acc gaa aaa ctt gcc act ggt ggt ata caa gtg	5581
Lys Gly Asn Asn Asp Thr Glu Lys Leu Ala Thr Gly Gly Ile Gln Val	
1665 1670 1675 1680	
ggc gtg gat aaa gac ggc aac gct aac ggc gat tta agc aat gtt tgg	5629
Gly Val Asp Lys Asp Gly Asn Ala Asn Gly Asp Leu Ser Asn Val Trp	
1685 1690 1695	
gtc aaa acc caa aaa gat ggc agc aaa aaa gcc ctg ctc gcc act tat	5677
Val Lys Thr Gln Lys Asp Gly Ser Lys Lys Ala Leu Leu Ala Thr Tyr	
1700 1705 1710	
aac gcc gca ggt cag acc aac tat ttg acc aac aac ccc gca gaa gcc	5725
Asn Ala Ala Gly Gln Thr Asn Tyr Leu Thr Asn Asn Pro Ala Glu Ala	
1715 1720 1725	
att gac aga ata aat gaa caa ggt atc cgc ttc ttc cat gtc aac gat	5773
Ile Asp Arg Ile Asn Glu Gln Gly Ile Arg Phe Phe His Val Asn Asp	
1730 1735 1740	
ggc aat caa gag cct gtg gta caa ggg cgt aac ggc att gac tca agt	5821
Gly Asn Gln Glu Pro Val Val Gln Gly Arg Asn Gly Ile Asp Ser Ser	
1745 1750 1755 1760	
gcc tca ggc aag cac tca gtg gcg ata ggt ttc cag gcc aag gca gat	5869
Ala Ser Gly Lys His Ser Val Ala Ile Gly Phe Gln Ala Lys Ala Asp	
1765 1770 1775	
ggt gaa gcc gcc gtt gcc ata ggc aga caa acc caa gca ggc aac caa	5917
Gly Glu Ala Ala Val Ala Ile Gly Arg Gln Thr Gln Ala Gly Asn Gln	
1780 1785 1790	
tcc atc gcc atc ggt gat aac gca caa gcc acg ggc gat caa tcc atc	5965
Ser Ile Ala Ile Gly Asp Asn Ala Gln Ala Thr Gly Asp Gln Ser Ile	
1795 1800 1805	

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gcc atc ggt aca ggc aat gtg gta gca ggt aag cac tct ggt gcc atc Ala Ile Gly Thr Gly Asn Val Val Ala Gly Lys His Ser Gly Ala Ile 1810 1815 1820	6013
ggc gac cca agc act gtt aag gct gat aac agt tac agt gtg ggt aat Gly Asp Pro Ser Thr Val Lys Ala Asp Asn Ser Tyr Ser Val Gly Asn 1825 1830 1835 1840	6061
aac aac cag ttt acc gat gcc act caa acc gat gtc ttt ggt gtg ggc Asn Asn Gln Phe Thr Asp Ala Thr Gln Thr Asp Val Phe Gly Val Gly 1845 1850 1855	6109
aat aac atc acc gtg acc gaa agt aac tcg gtt gcc tta ggt tca aac Asn Asn Ile Thr Val Thr Glu Ser Asn Ser Val Ala Leu Gly Ser Asn 1860 1865 1870	6157
tct gcc atc agt gca ggc aca cac gca ggc aca caa gcc aaa aaa tct Ser Ala Ile Ser Ala Gly Thr His Ala Gly Thr Gln Ala Lys Lys Ser 1875 1880 1885	6205
gac ggc aca gca ggt aca acc acc aca gca ggt gca acc ggt acg gtt Asp Gly Thr Ala Gly Thr Thr Thr Thr Ala Gly Ala Thr Gly Thr Val 1890 1895 1900	6253
aaa ggc ttt gct gga caa acg gcg gtt ggt gcg gtc tcc gtg ggt gcc Lys Gly Phe Ala Gly Gln Thr Ala Val Gly Ala Val Ser Val Gly Ala 1905 1910 1915 1920	6301
tca ggt gct gaa cgc cgt atc caa aat gtg gca gca ggt gag gtc agt Ser Gly Ala Glu Arg Arg Ile Gln Asn Val Ala Ala Gly Glu Val Ser 1925 1930 1935	6349
gcc acc agc acc gat gcg gtc aat ggt agc cag ttg tac aaa gcc acc Ala Thr Ser Thr Asp Ala Val Asn Gly Ser Gln Leu Tyr Lys Ala Thr 1940 1945 1950	6397
caa agc att gcc aac gca acc aat gag ctt gac cat cgt atc cac caa Gln Ser Ile Ala Asn Ala Thr Asn Glu Leu Asp His Arg Ile His Gln 1955 1960 1965	6445
aac gaa aat aag gcc aat gca ggg att tca tca gcg atg gcg atg gcg Asn Glu Asn Lys Ala Asn Ala Gly Ile Ser Ser Ala Met Ala Met Ala 1970 1975 1980	6493
tcc atg cca caa gcc tac att cct ggc aga tcc atg gtt acc ggg ggt Ser Met Pro Gln Ala Tyr Ile Pro Gly Arg Ser Met Val Thr Gly Gly 1985 1990 1995 2000	6541
att gcc acc cac aac ggt caa ggt gcg gtg gca gtg gga ctg tcg aag Ile Ala Thr His Asn Gly Gln Gly Ala Val Ala Val Gly Leu Ser Lys 2005 2010 2015	6589
ctg tcg gat aat ggt caa tgg gta ttt aaa atc aat ggt tca gcc gat Leu Ser Asp Asn Gly Gln Trp Val Phe Lys Ile Asn Gly Ser Ala Asp 2020 2025 2030	6637
acc caa ggc cat gta ggg gcg gca gtt ggt gca ggt ttt cac ttt Thr Gln Gly His Val Gly Ala Ala Val Gly Ala Gly Phe His Phe	6682

2035

2040

2045

taagccataa atcgcaagat tttacttaaa aatcaatctc accatagttg tataaaacag 6742
catcagcatc agtcatatta ctgatgctga tgttttttat cacttaaacc attttaccgc 6802
tcaagtgatt ctctttcacc atgaccaa atcgccattgat cataggtaaa cttattgagt 6862
aaattttatc aatgtagttg ttagatatgg ttaaaattgt gccattgacc aaaaaatgac 6922
cgatttatcc cgaaaatttc tgattatgat ccgttgacct gcaggtcgac 6972

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Figure 4. *M. catarrhalis* strain Q8 200kDa gene

ATG aat cac atc tat aaa gtc atc ttt aac aaa gcc aca ggc aca ttt	48
Met Asn His Ile Tyr Lys Val Ile Phe Asn Lys Ala Thr Gly Thr Phe	
1 5 10 15	
atg gcc gtg gcg gaa tat gcc aaa tcc cac agt acg ggg ggg ggt agc	96
Met Ala Val Ala Glu Tyr Ala Lys Ser His Ser Thr Gly Gly Gly Ser	
20 25 30	
tgt gct aca ggg caa gtt ggc agt gta cgc act cta agc ttt gcc cgt	144
Cys Ala Thr Gly Gln Val Gly Ser Val Arg Thr Leu Ser Phe Ala Arg	
35 40 45	
att gcc gcg ctc gct gtc ctc gtg atc ggt gcg acg ctc aat ggc agt	192
Ile Ala Ala Leu Ala Val Leu Val Ile Gly Ala Thr Leu Asn Gly Ser	
50 55 60	
gct tat gct caa caa att act acc aag atc gaa att ggt caa aca aac	240
Ala Tyr Ala Gln Gln Ile Thr Thr Lys Ile Glu Ile Gly Gln Thr Asn	
65 70 75 80	
aag ata aac aac acg ctg aaa ggc gat gcc cta gcg aca ggt gaa gca	288
Lys Ile Asn Asn Thr Leu Lys Gly Asp Ala Leu Ala Thr Gly Glu Ala	
85 90 95	
tcc att gct ttt ggt agt ctt tct aag gca caa ggc tct caa gct att	336
Ser Ile Ala Phe Gly Ser Leu Ser Lys Ala Gln Gly Ser Gln Ala Ile	
100 105 110	
gct atc ggt agt gtc aaa cca gat cct aat aat ggt agt aat ggt aat	384
Ala Ile Gly Ser Val Lys Pro Asp Pro Asn Asn Gly Ser Asn Gly Asn	
115 120 125	
gta ggt tcc cac gcc aaa ggt aac gag tcc atc gcc atc ggt ggt gat	432
Val Gly Ser His Ala Lys Gly Asn Glu Ser Ile Ala Ile Gly Gly Asp	
130 135 140	
gta ttg gct gag ggt gat gcc tcg att gcc atc ggt agt gat gac tta	480
Val Leu Ala Glu Gly Asp Ala Ser Ile Ala Ile Gly Ser Asp Asp Leu	
145 150 155 160	
tat ttg cct aag aat ctt gat ctg aag aat gaa ttt cac aaa ctt att	528
Tyr Leu Pro Lys Asn Leu Asp Leu Lys Asn Glu Phe His Lys Leu Ile	
165 170 175	
cat ggc cat gaa ata tta aaa aaa ata caa acc tca acc gat ggt aaa	576
His Gly His Glu Ile Leu Lys Lys Ile Gln Thr Ser Thr Asp Gly Lys	
180 185 190	
atc aaa tat cga cgc aca aga gca caa ggg cac gcc agt act gca gtg	624
Ile Lys Tyr Arg Arg Thr Arg Ala Gln Gly His Ala Ser Thr Ala Val	
195 200 205	
gga gcc atg tca tat gca cag ggt cat ttt tcc aac gcc ttt ggt aca	672
Gly Ala Met Ser Tyr Ala Gln Gly His Phe Ser Asn Ala Phe Gly Thr	
210 215 220	

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tac gca aca gct gaa gct gcc tat tcc ttg gca gta ggt ctt gcc gcc	720
Tyr Ala Thr Ala Glu Ala Ala Tyr Ser Leu Ala Val Gly Leu Ala Ala	
225 230 235 240	
caa gcc aca aaa caa tct tca atc gct gtt ggt tcc aat gca aaa gct	768
Gln Ala Thr Lys Gln Ser Ser Ile Ala Val Gly Ser Asn Ala Lys Ala	
245 250 255	
aac gcg ttt gca gcg aca gcc att ggt gga aat act gta gtt aat ttg	816
Asn Ala Phe Ala Ala Thr Ala Ile Gly Gly Asn Thr Val Val Asn Leu	
260 265 270	
ggt cga ggc gtt gcc cta ggt ttt ggt tct cag atc ctt gat agg gat	864
Gly Arg Gly Val Ala Leu Gly Phe Gly Ser Gln Ile Leu Asp Arg Asp	
275 280 285	
aat aat aca gat gcc agt gcc tat gta cca cta ggt aaa acg tta gca	912
Asn Asn Thr Asp Ala Ser Ala Tyr Val Pro Leu Gly Lys Thr Leu Ala	
290 295 300	
gac cag tat aaa gcc acc cgc cag ggt gat tct acg gat ata ttt tcc	960
Asp Gln Tyr Lys Ala Thr Arg Gln Gly Asp Ser Thr Asp Ile Phe Ser	
305 310 315 320	
att ggt aat agt aat aat aat aat agc agt atc agg cgt aaa atc atc	1008
Ile Gly Asn Ser Asn Asn Asn Asn Ser Ser Ile Arg Arg Lys Ile Ile	
325 330 335	
aat gtc ggt gcg ggt tct cgg gat acc gat gcg gtc aat gtg gca cag	1056
Asn Val Gly Ala Gly Ser Arg Asp Thr Asp Ala Val Asn Val Ala Gln	
340 345 350	
ctt aaa ttg gtg gag gaa ctg gct aat cgt aaa att act ttt aag ggt	1104
Leu Lys Leu Val Glu Glu Leu Ala Asn Arg Lys Ile Thr Phe Lys Gly	
355 360 365	
gat ggt gac aat aat agc aat agc gta gaa aga ggt ttg ggc aat act	1152
Asp Gly Asp Asn Asn Ser Asn Ser Val Glu Arg Gly Leu Gly Asn Thr	
370 375 380	
tta act att aaa ggt gat gca cag acc aac gca tta acc gaa gct aac	1200
Leu Thr Ile Lys Gly Asp Ala Gln Thr Asn Ala Leu Thr Glu Ala Asn	
385 390 395 400	
atc ggt gtg gta aca gat ggc aat ggt ctg aaa gtt aaa ctt gct aaa	1248
Ile Gly Val Val Thr Asp Gly Asn Gly Leu Lys Val Lys Leu Ala Lys	
405 410 415	
gag ctg act gga ttg acc agt gtc tcc gct acc aac aaa atc acc gtt	1296
Glu Leu Thr Gly Leu Thr Ser Val Ser Ala Thr Asn Lys Ile Thr Val	
420 425 430	
agt aat acc aac aac aac aac gcc gag cta caa agc ggt ggt ttg acc	1344
Ser Asn Thr Asn Asn Asn Asn Ala Glu Leu Gln Ser Gly Gly Leu Thr	
435 440 445	
ttt agc cca ata aca ggt aca aaa aca gat aaa acc gtc tac agc att	1392
Phe Ser Pro Ile Thr Gly Thr Lys Thr Asp Lys Thr Val Tyr Ser Ile	
450 455 460	

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gat gga ttg aag ttt act aat gat agt aat agt ata gca act aaa ggt	1440
Asp Gly Leu Lys Phe Thr Asn Asp Ser Asn Ser Ile Ala Thr Lys Gly	
465 470 475 480	
act act cgt att acc aaa aag aaa att ggt ttt gct ggt act aat gat	1488
Thr Thr Arg Ile Thr Lys Lys Lys Ile Gly Phe Ala Gly Thr Asn Asp	
485 490 495	
gga gtt gat gaa agc aaa cct tat ctt gac aac gaa aag cta aaa gtt	1536
Gly Val Asp Glu Ser Lys Pro Tyr Leu Asp Asn Glu Lys Leu Lys Val	
500 505 510	
ggc aac agc acc cta aac agt ggt agc ttg act gtt aat aac acc act	1584
Gly Asn Ser Thr Leu Asn Ser Gly Ser Leu Thr Val Asn Asn Thr Thr	
515 520 525	
ggg aat aaa caa atc caa gtc ggt gct aat ggc att aaa ttt gcc aca	1632
Gly Asn Lys Gln Ile Gln Val Gly Ala Asn Gly Ile Lys Phe Ala Thr	
530 535 540	
gtc gct aat aat gtt gca aat acc tca gca aca gtc ggc act gct cgt	1680
Val Ala Asn Asn Val Ala Asn Thr Ser Ala Thr Val Gly Thr Ala Arg	
545 550 555 560	
att acc gaa gag aaa att ggt ttt gct ggt act aat gat gga gtt gat	1728
Ile Thr Glu Glu Lys Ile Gly Phe Ala Gly Thr Asn Asp Gly Val Asp	
565 570 575	
gaa caa gca cca tat ttg gat aaa gaa cga ctt aaa gtg ggt cgt gtt	1776
Glu Gln Ala Pro Tyr Leu Asp Lys Glu Arg Leu Lys Val Gly Arg Val	
580 585 590	
gaa att acc aca gat agt ggt att aat gct ggt aat cac aag att acc	1824
Glu Ile Thr Thr Asp Ser Gly Ile Asn Ala Gly Asn His Lys Ile Thr	
595 600 605	
gga ctt act aat ggt ata gca aat acc gat gcg gtt acc atc aaa cag	1872
Gly Leu Thr Asn Gly Ile Ala Asn Thr Asp Ala Val Thr Ile Lys Gln	
610 615 620	
ctc aaa gac gcc aag cct act tta aac gca ggc gat ggc atc agt att	1920
Leu Lys Asp Ala Lys Pro Thr Leu Asn Ala Gly Asp Gly Ile Ser Ile	
625 630 635 640	
aat agt aat aac ggg gat cta gtt gat agt agt ggc aat att acc acc	1968
Asn Ser Asn Asn Gly Asp Leu Val Asp Ser Ser Gly Asn Ile Thr Thr	
645 650 655	
cca act tat aac att agc gtg aaa acc act aag ctt aac agt aat ggc	2016
Pro Thr Tyr Asn Ile Ser Val Lys Thr Thr Lys Leu Asn Ser Asn Gly	
660 665 670	
acc agt ggt aat aat aaa ttt agt gtt agt aat gct cat gat aac aat	2064
Thr Ser Gly Asn Asn Lys Phe Ser Val Ser Asn Ala His Asp Asn Asn	
675 680 685	
agc tta gtt acc gcc aaa gat ttg gca gac tat cta aat aaa gtc aat	2112
Ser Leu Val Thr Ala Lys Asp Leu Ala Asp Tyr Leu Asn Lys Val Asn	

690	695	700	
gaa acg gct gac agt gct cta cca agc ttt aaa gtc caa aac ggt gat Glu Thr Ala Asp Ser Ala Leu Pro Ser Phe Lys Val Gln Asn Gly Asp 705 710 715 720			2160
aat agc aac aac gcc atc acc gtg ggt aaa gat aca aac ggc aag acc Asn Ser Asn Asn Ala Ile Thr Val Gly Lys Asp Thr Asn Gly Lys Thr 725 730 735			2208
ttc aac acc tta aaa ctc aaa ggt gaa aac ggt gtt aat att acg acc Phe Asn Thr Leu Lys Leu Lys Gly Glu Asn Gly Val Asn Ile Thr Thr 740 745 750			2256
aat aga gcc aca ggt aca gtt acc ttt ggc att gac caa agt aat ggt Asn Arg Ala Thr Gly Thr Val Thr Phe Gly Ile Asp Gln Ser Asn Gly 755 760 765			2304
ctc acc acg cct aag ctg acc gtg ggt agc gat aca aat ggt aat cga Leu Thr Thr Pro Lys Leu Thr Val Gly Ser Asp Thr Asn Gly Asn Arg 770 775 780			2352
ttg gtt att gag caa gtc cct agc gct gac ggt aac agc acc aaa aac Leu Val Ile Glu Gln Val Pro Ser Ala Asp Gly Asn Ser Thr Lys Asn 785 790 795 800			2400
atc att aaa gga ttg tcc cca aca ctg cct agc att gcc agt cca agt Ile Ile Lys Gly Leu Ser Pro Thr Leu Pro Ser Ile Ala Ser Pro Ser 805 810 815			2448
ggc cgc aac ata gca ctg ggc aat aca atc gaa gaa aaa gac aaa tcc Gly Arg Asn Ile Ala Leu Gly Asn Thr Ile Glu Glu Lys Asp Lys Ser 820 825 830			2496
aac gct gcc agc att gat gat gtg cta aat gca ggc ttt aac cta aaa Asn Ala Ala Ser Ile Asp Asp Val Leu Asn Ala Gly Phe Asn Leu Lys 835 840 845			2544
aat aat ggc aaa gac aaa gac ttt gtc tcc act tat gac act gtt gac Asn Asn Gly Lys Asp Lys Asp Phe Val Ser Thr Tyr Asp Thr Val Asp 850 855 860			2592
ttt atc gat ggc aat gcc acc acc gcc aca gta act tat gat gaa gcc Phe Ile Asp Gly Asn Ala Thr Thr Ala Thr Val Thr Tyr Asp Glu Ala 865 870 875 880			2640
aat caa acc agt aaa gtg gcg tat gat gtg aat gtg gat gag aaa acc Asn Gln Thr Ser Lys Val Ala Tyr Asp Val Asn Val Asp Glu Lys Thr 885 890 895			2688
att gaa ctg aca ggc gat aat ggc aag aaa caa ctt ggc gtc aaa acc Ile Glu Leu Thr Gly Asp Asn Gly Lys Lys Gln Leu Gly Val Lys Thr 900 905 910			2736
atc aaa ctg acc gaa aca agt act aat ggt aat gca act aca ttt agt Ile Lys Leu Thr Glu Thr Ser Thr Asn Gly Asn Ala Thr Thr Phe Ser 915 920 925			2784
acc gac gat gac cat gcc ctt gtt aaa gcc agt gat atc gcc ggc aat			2832

Thr	Asp	Asp	Asp	His	Ala	Leu	Val	Lys	Ala	Ser	Asp	Ile	Ala	Gly	Asn		
930						935					940						
cta	aac	acc	cta	gcc	gag	gaa	att	cac	acc	acc	aaa	ggc	aca	gca	aac	2880	
Leu	Asn	Thr	Leu	Ala	Glu	Glu	Ile	His	Thr	Thr	Lys	Gly	Thr	Ala	Asn		
945					950					955					960		
acc	gcc	cta	caa	acc	ttt	acc	gtt	aaa	aag	gta	gat	gaa	aat	gat	aag	2928	
Thr	Ala	Leu	Gln	Thr	Phe	Thr	Val	Lys	Lys	Val	Asp	Glu	Asn	Asp	Lys		
				965					970					975			
gct	gat	gac	acc	aac	gcc	atc	acc	gtg	ggc	aaa	gat	ggc	aca	agt	ggc	2976	
Ala	Asp	Asp	Thr	Asn	Ala	Ile	Thr	Val	Gly	Lys	Asp	Gly	Thr	Ser	Gly		
			980					985					990				
aaa	gtc	aac	acc	tta	aaa	ctc	aaa	ggc	aaa	aac	ggc	ctt	gat	att	aaa	3024	
Lys	Val	Asn	Thr	Leu	Lys	Leu	Lys	Gly	Lys	Asn	Gly	Leu	Asp	Ile	Lys		
		995				1000					1005						
acc	gac	aaa	gat	ggc	acg	gtt	acc	ttt	ggc	att	aac	acc	caa	agc	ggc	3072	
Thr	Asp	Lys	Asp	Gly	Thr	Val	Thr	Phe	Gly	Ile	Asn	Thr	Gln	Ser	Gly		
	1010					1015				1020							
ctt	aaa	gcc	ggc	gac	agc	acc	act	cta	aac	aac	aat	ggc	ttg	tct	att	3120	
Leu	Lys	Ala	Gly	Asp	Ser	Thr	Thr	Leu	Asn	Asn	Asn	Gly	Leu	Ser	Ile		
1025					1030					1035					1040		
aaa	aac	acc	gct	agt	aac	gaa	caa	atc	caa	gtc	ggc	gct	gat	ggc	gtg	3168	
Lys	Asn	Thr	Ala	Ser	Asn	Glu	Gln	Ile	Gln	Val	Gly	Ala	Asp	Gly	Val		
				1045					1050				1055				
aag	ttt	gcc	atg	gtt	aat	aat	ggc	gtt	gta	ggc	gct	ggc	att	gat	ggc	3216	
Lys	Phe	Ala	Met	Val	Asn	Asn	Gly	Val	Val	Gly	Ala	Gly	Ile	Asp	Gly		
		1060					1065					1070					
aca	act	cgc	att	acc	aga	gat	gaa	att	ggc	ttt	act	ggg	act	aat	ggc	3264	
Thr	Thr	Arg	Ile	Thr	Arg	Asp	Glu	Ile	Gly	Phe	Thr	Gly	Thr	Asn	Gly		
		1075				1080					1085						
tca	ctt	gat	aaa	agc	aaa	ccc	cac	cta	agc	aaa	gac	ggc	att	aac	gca	3312	
Ser	Leu	Asp	Lys	Ser	Lys	Pro	His	Leu	Ser	Lys	Asp	Gly	Ile	Asn	Ala		
	1090					1095					1100						
ggc	ggc	aaa	aag	att	acc	aac	att	caa	tca	ggc	gag	att	gcc	aaa	aac	3360	
Gly	Gly	Lys	Lys	Ile	Thr	Asn	Ile	Gln	Ser	Gly	Glu	Ile	Ala	Lys	Asn		
1105					1110					1115					1120		
agc	cat	gat	gct	gtg	aca	ggc	ggc	aag	att	tat	gat	tta	aaa	acc	gaa	3408	
Ser	His	Asp	Ala	Val	Thr	Gly	Gly	Lys	Ile	Tyr	Asp	Leu	Lys	Thr	Glu		
				1125					1130					1135			
ctt	gaa	aat	aaa	atc	agc	agt	act	gcc	aaa	aca	gca	caa	aac	tca	tta	3456	
Leu	Glu	Asn	Lys	Ile	Ser	Ser	Thr	Ala	Lys	Thr	Ala	Gln	Asn	Ser	Leu		
			1140					1145				1150					
cac	gaa	ttc	tca	gta	gca	gat	gaa	caa	ggc	aat	aac	ttt	acg	gtt	agt	3504	
His	Glu	Phe	Ser	Val	Ala	Asp	Glu	Gln	Gly	Asn	Asn	Phe	Thr	Val	Ser		
		1155					1160					1165					

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aac cct tac tcc agt tat gac acc tca aag acc tct gat gtc atc acc	3552
Asn Pro Tyr Ser Ser Tyr Asp Thr Ser Lys Thr Ser Asp Val Ile Thr	
1170 1175 1180	
ttt gca ggt gaa aac ggc att acc acc aag gta aat aaa ggt gtg gtg	3600
Phe Ala Gly Glu Asn Gly Ile Thr Thr Lys Val Asn Lys Gly Val Val	
1185 1190 1195 1200	
cgt gtg ggc att gac caa acc aaa ggc tta acc acg cct aag ctg acc	3648
Arg Val Gly Ile Asp Gln Thr Lys Gly Leu Thr Thr Pro Lys Leu Thr	
1205 1210 1215	
gtg ggt aat aat aat ggc aaa ggc att gtc att aac agc caa aat ggt	3696
Val Gly Asn Asn Asn Gly Lys Gly Ile Val Ile Asn Ser Gln Asn Gly	
1220 1225 1230	
caa aat acc atc aca gga cta agc aac act cta gct aat gtt acc aat	3744
Gln Asn Thr Ile Thr Gly Leu Ser Asn Thr Leu Ala Asn Val Thr Asn	
1235 1240 1245	
gat aaa ggt agc gta cgc acc aca gaa cag ggc aat ata atc aaa gac	3792
Asp Lys Gly Ser Val Arg Thr Thr Glu Gln Gly Asn Ile Ile Lys Asp	
1250 1255 1260	
gaa gac aaa acc cgt gcc gcc agc att gtt gat gtg cta agc gca ggc	3840
Glu Asp Lys Thr Arg Ala Ala Ser Ile Val Asp Val Leu Ser Ala Gly	
1265 1270 1275 1280	
ttt aac ttg caa ggc aat ggt gaa gcg gtt gac ttt gtc tcc act tat	3888
Phe Asn Leu Gln Gly Asn Gly Glu Ala Val Asp Phe Val Ser Thr Tyr	
1285 1290 1295	
gac acc gtc aac ttt gcc aat ggc aat acc acc acc gct aag gtg acc	3936
Asp Thr Val Asn Phe Ala Asn Gly Asn Thr Thr Thr Ala Lys Val Thr	
1300 1305 1310	
tat gat gac aca agc aaa acc agt aaa gtg gtc tat gat gtc aat gtg	3984
Tyr Asp Asp Thr Ser Lys Thr Ser Lys Val Val Tyr Asp Val Asn Val	
1315 1320 1325	
gat gat aca acc att gaa gtt aaa gat aaa aaa ctt ggc gta aaa acc	4032
Asp Asp Thr Thr Ile Glu Val Lys Asp Lys Lys Leu Gly Val Lys Thr	
1330 1335 1340	
acc aca ttg acc agt act ggc aca ggt gct aat aaa ttt gcc cta agc	4080
Thr Thr Leu Thr Ser Thr Gly Thr Gly Ala Asn Lys Phe Ala Leu Ser	
1345 1350 1355 1360	
aat caa gct act ggc gat gcg ctt gtc aag gcc agt gat atc gtt gct	4128
Asn Gln Ala Thr Gly Asp Ala Leu Val Lys Ala Ser Asp Ile Val Ala	
1365 1370 1375	
cat cta aac acc tta tct ggc gac atc caa act gcc aaa ggg gca agc	4176
His Leu Asn Thr Leu Ser Gly Asp Ile Gln Thr Ala Lys Gly Ala Ser	
1380 1385 1390	
caa gcg aac aac tca gca ggc tat gtg gat gct gat ggc aat aag gtc	4224
Gln Ala Asn Asn Ser Ala Gly Tyr Val Asp Ala Asp Gly Asn Lys Val	
1395 1400 1405	

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atc tat gac agt acc gat aac aag tac tat caa gcc aaa aat gat ggc Ile Tyr Asp Ser Thr Asp Asn Lys Tyr Tyr Gln Ala Lys Asn Asp Gly 1410 1415 1420	4272
aca gtt gat aaa acc aaa gaa gtt gcc aaa gac aaa ctg gtc gcc caa Thr Val Asp Lys Thr Lys Glu Val Ala Lys Asp Lys Leu Val Ala Gln 1425 1430 1435 1440	4320
gcc caa acc cca gat ggc aca ttg gct caa atg aat gtc aaa tca gtc Ala Gln Thr Pro Asp Gly Thr Leu Ala Gln Met Asn Val Lys Ser Val 1445 1450 1455	4368
att aac aaa gaa caa gta aat gat gcc aat aaa aag caa ggc atc aat Ile Asn Lys Glu Gln Val Asn Asp Ala Asn Lys Lys Gln Gly Ile Asn 1460 1465 1470	4416
gaa gac aac gcc ttt gtt aaa gga ctt gaa aaa gcc gct tct gat aac Glu Asp Asn Ala Phe Val Lys Gly Leu Glu Lys Ala Ala Ser Asp Asn 1475 1480 1485	4464
aaa acc aaa aac gcc gca gta act gtg ggt gat tta aat gcc gtt gcc Lys Thr Lys Asn Ala Ala Val Thr Val Gly Asp Leu Asn Ala Val Ala 1490 1495 1500	4512
caa aca ccg ctg acc ttt gca ggg gat aca ggc aca acg gct aaa aaa Gln Thr Pro Leu Thr Phe Ala Gly Asp Thr Gly Thr Thr Ala Lys Lys 1505 1510 1515 1520	4560
ctg ggc gag act ttg acc atc aaa ggt ggg caa aca gac acc aat aag Leu Gly Glu Thr Leu Thr Ile Lys Gly Gly Gln Thr Asp Thr Asn Lys 1525 1530 1535	4608
cta acc gat aat aac atc ggt gtg gta gca ggt act gat ggc ttc act Leu Thr Asp Asn Asn Ile Gly Val Val Ala Gly Thr Asp Gly Phe Thr 1540 1545 1550	4656
gtc aaa ctt gcc aaa gac cta acc aat ctt aac agc gtt aat gca ggt Val Lys Leu Ala Lys Asp Leu Thr Asn Leu Asn Ser Val Asn Ala Gly 1555 1560 1565	4704
ggc acc aaa att gat gaa aaa ggc atc tct ttt gta gac gca aac ggt Gly Thr Lys Ile Asp Glu Lys Gly Ile Ser Phe Val Asp Ala Asn Gly 1570 1575 1580	4752
caa gcc aaa gca aac acc cct gtg cta agt gcc aat ggg ctg gac ctg Gln Ala Lys Ala Asn Thr Pro Val Leu Ser Ala Asn Gly Leu Asp Leu 1585 1590 1595 1600	4800
ggc ggc aag gtc atc agt aat gtg ggc aaa ggc aca aaa gat acc gac Gly Gly Lys Val Ile Ser Asn Val Gly Lys Gly Thr Lys Asp Thr Asp 1605 1610 1615	4848
gct gcc aat gta caa cag tta aac gaa gta cgc aac ttg ttg ggt ctt Ala Ala Asn Val Gln Gln Leu Asn Glu Val Arg Asn Leu Leu Gly Leu 1620 1625 1630	4896
ggc aat gat aac gct gac ggc aat cag gta aac att gcc gac atc aaa Gly Asn Asp Asn Ala Asp Gly Asn Gln Val Asn Ile Ala Asp Ile Lys	4944

1635	1640	1645	
aaa gac cca aat tca ggt tca tca tct aac cgc act gtc atc aaa gca			4992
Lys Asp Pro Asn Ser Gly Ser Ser Ser Asn Arg Thr Val Ile Lys Ala			
1650	1655	1660	
ggc acg gta ctt ggc ggt aaa ggt aat aac gat acc gaa aaa ctt gcc			5040
Gly Thr Val Leu Gly Gly Lys Gly Asn Asn Asp Thr Glu Lys Leu Ala			
1665	1670	1675	1680
act ggt ggt gta caa gtg ggc gtg gat aaa gac ggc aac gct aac ggc			5088
Thr Gly Gly Val Gln Val Gly Val Asp Lys Asp Gly Asn Ala Asn Gly			
1685	1690	1695	
gat tta agc aat gtt tgg gtc aaa acc caa aaa gat ggc agc aaa aaa			5136
Asp Leu Ser Asn Val Trp Val Lys Thr Gln Lys Asp Gly Ser Lys Lys			
1700	1705	1710	
gcc ctg ctc gcc act tat aac gcc gca ggt cag acc aac tat gtg acc			5184
Ala Leu Leu Ala Thr Tyr Asn Ala Ala Gly Gln Thr Asn Tyr Val Thr			
1715	1720	1725	
aac aac ccc gca gaa gcc att gac aga ata aat gaa caa ggt atc cgc			5232
Asn Asn Pro Ala Glu Ala Ile Asp Arg Ile Asn Glu Gln Gly Ile Arg			
1730	1735	1740	
ttc ttc cat gtc aac gat ggc aat caa gag cct gtg gta caa ggg cgt			5280
Phe Phe His Val Asn Asp Gly Asn Gln Glu Pro Val Val Gln Gly Arg			
1745	1750	1755	1760
aac ggc att gac tca agt gcc tca ggc aag cac tca gtg gcg ata ggt			5328
Asn Gly Ile Asp Ser Ser Ala Ser Gly Lys His Ser Val Ala Ile Gly			
1765	1770	1775	
ttc cag gcc aag gca gat ggt gaa gcc gcc gtt gcc ata ggc aga caa			5376
Phe Gln Ala Lys Ala Asp Gly Glu Ala Ala Val Ala Ile Gly Arg Gln			
1780	1785	1790	
acc caa gca ggc aac caa tcc atc gcc atc ggt gat aac gca caa gcc			5424
Thr Gln Ala Gly Asn Gln Ser Ile Ala Ile Gly Asp Asn Ala Gln Ala			
1795	1800	1805	
acg ggc gat caa tcc atc gcc atc ggt aca ggc aat gtg gta gca ggt			5472
Thr Gly Asp Gln Ser Ile Ala Ile Gly Thr Gly Asn Val Val Ala Gly			
1810	1815	1820	
aag cac tct ggt gcc atc ggc gac cca agc act gtt aag gct gat aac			5520
Lys His Ser Gly Ala Ile Gly Asp Pro Ser Thr Val Lys Ala Asp Asn			
1825	1830	1835	1840
agt tac agt gtg ggt aat aac aac cag ttt acc gat gcc act caa acc			5568
Ser Tyr Ser Val Gly Asn Asn Asn Gln Phe Thr Asp Ala Thr Gln Thr			
1845	1850	1855	
gat gtc ttt ggt gtg ggc aat aac atc acc gtg acc gaa agt aac tcg			5616
Asp Val Phe Gly Val Gly Asn Asn Ile Thr Val Thr Glu Ser Asn Ser			
1860	1865	1870	
gtt gcc tta ggt tca aac tct gcc atc agt gca ggc aca cac gca ggc			5664

Val	Ala	Leu	Gly	Ser	Asn	Ser	Ala	Ile	Ser	Ala	Gly	Thr	His	Ala	Gly		
1875							1880					1885					
aca	caa	gcc	aaa	aaa	tct	gac	ggc	aca	gca	ggg	aca	acc	acc	aca	gca	5712	
Thr	Gln	Ala	Lys	Lys	Ser	Asp	Gly	Thr	Ala	Gly	Thr	Thr	Thr	Thr	Ala		
1890						1895					1900						
ggg	gcc	aca	ggg	acg	gtt	aaa	ggc	ttt	gct	gga	caa	acg	gcg	gtt	ggg	5760	
Gly	Ala	Thr	Gly	Thr	Val	Lys	Gly	Phe	Ala	Gly	Gln	Thr	Ala	Val	Gly		
1905					1910					1915					1920		
gcg	gtc	tcc	gtg	ggg	gcc	tca	ggg	gct	gaa	cgc	cgt	atc	caa	aat	gtg	5808	
Ala	Val	Ser	Val	Gly	Ala	Ser	Gly	Ala	Glu	Arg	Arg	Ile	Gln	Asn	Val		
			1925					1930					1935				
gca	gca	ggg	gag	gtc	agt	gcc	acc	agc	acc	gat	gcg	gtc	aat	ggg	agc	5856	
Ala	Ala	Gly	Glu	Val	Ser	Ala	Thr	Ser	Thr	Asp	Ala	Val	Asn	Gly	Ser		
		1940					1945					1950					
cag	ttg	tac	aaa	gcc	acc	caa	agc	att	gcc	aac	gca	acc	aat	gag	ctt	5904	
Gln	Leu	Tyr	Lys	Ala	Thr	Gln	Ser	Ile	Ala	Asn	Ala	Thr	Asn	Glu	Leu		
	1955						1960					1965					
gac	cat	cgt	atc	cac	caa	aac	gaa	aat	aaa	gcc	aat	gca	ggg	att	tca	5952	
Asp	His	Arg	Ile	His	Gln	Asn	Glu	Asn	Lys	Ala	Asn	Ala	Gly	Ile	Ser		
	1970					1975					1980						
tca	gcg	atg	gcg	atg	gcg	tcc	atg	cca	caa	gcc	tac	att	cct	ggc	aga	6000	
Ser	Ala	Met	Ala	Met	Ala	Ser	Met	Pro	Gln	Ala	Tyr	Ile	Pro	Gly	Arg		
1985					1990					1995					2000		
tcc	atg	gtt	acc	ggg	ggg	att	gcc	acc	cac	aac	ggg	caa	ggg	gcg	gtg	6048	
Ser	Met	Val	Thr	Gly	Gly	Ile	Ala	Thr	His	Asn	Gly	Gln	Gly	Ala	Val		
			2005					2010					2015				
gca	gtg	gga	ctg	tcg	aag	ctg	tcg	gat	aat	ggg	caa	tgg	gta	ttt	aaa	6096	
Ala	Val	Gly	Leu	Ser	Lys	Leu	Ser	Asp	Asn	Gly	Gln	Trp	Val	Phe	Lys		
		2020					2025					2030					
atc	aat	ggg	tca	gcc	gat	acc	caa	ggc	cat	gta	ggg	gcg	gca	gtt	ggg	6144	
Ile	Asn	Gly	Ser	Ala	Asp	Thr	Gln	Gly	His	Val	Gly	Ala	Ala	Val	Gly		
	2035					2040					2045						
gca	ggg	ttt	cac	ttt												6159	
Ala	Gly	Phe	His	Phe													
	2050																

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Figure 5. *Moraxella catarrhalis* les1 200kDa

ATG aat cac atc tat aaa gtc atc ttt aac aaa gcc aca ggc aca ttt	48
Met Asn His Ile Tyr Lys Val Ile Phe Asn Lys Ala Thr Gly Thr Phe	
1 5 10 15	
atg gcc gtg gca gag tgc gcc aaa tcc cac agc gga <u>ggg</u> agt agc agt	96
Met Ala Val Ala Glu Cys Ala Lys Ser His Ser Gly Gly Ser Ser Ser	
20 25 30	
agt acc gca gga cag gtg ggc agc tct cct gtc atc cgc ctg act cgt	144
Ser Thr Ala Gly Gln Val Gly Ser Ser Pro Val Ile Arg Leu Thr Arg	
35 40 45	
gtt gcc acg ctc gct atc cta gtg atc ggt gcg acg ctc aat ggc agt	192
Val Ala Thr Leu Ala Ile Leu Val Ile Gly Ala Thr Leu Asn Gly Ser	
50 55 60	
gct tat gct caa aat aat agc aag atc gca ttt ggt acc aca ggc aac	240
Ala Tyr Ala Gln Asn Asn Ser Lys Ile Ala Phe Gly Thr Thr Gly Asn	
65 70 75 80	
aat gac aat gcc tcg gct agc aat gaa gca tcc att gct att ggt agt	288
Asn Asp Asn Ala Ser Ala Ser Asn Glu Ala Ser Ile Ala Ile Gly Ser	
85 90 95	
ctt gct aag gca cat gcc aat caa gct att gct atc ggt ggt agc aaa	336
Leu Ala Lys Ala His Ala Asn Gln Ala Ile Ala Ile Gly Gly Ser Lys	
100 105 110	
cca gat cct cgt aat caa gcg gct aat cag aag gca ggt tcc cac gcc	384
Pro Asp Pro Arg Asn Gln Ala Ala Asn Gln Lys Ala Gly Ser His Ala	
115 120 125	
aaa ggt aaa gag tcc atc gcc atc ggt ggt gat gta ctg gct gag ggt	432
Lys Gly Lys Glu Ser Ile Ala Ile Gly Gly Asp Val Leu Ala Glu Gly	
130 135 140	
gat gcc tcg att gcc att ggt agt gat gac tta tat ttg gat agg aat	480
Asp Ala Ser Ile Ala Ile Gly Ser Asp Asp Leu Tyr Leu Asp Arg Asn	
145 150 155 160	
agc act aac tct aaa tat cca aat ggt ctt ctt agc act ctt att caa	528
Ser Thr Asn Ser Lys Tyr Pro Asn Gly Leu Leu Ser Thr Leu Ile Gln	
165 170 175	
aac cat aca gta tta cgc caa ata cga gac tca aat ggt tct cag aaa	576
Asn His Thr Val Leu Arg Gln Ile Arg Asp Ser Asn Gly Ser Gln Lys	
180 185 190	
tat aga cgc aca gca gca gaa gga cac gcc agt act gca gtg gga gcc	624
Tyr Arg Arg Thr Ala Ala Glu Gly His Ala Ser Thr Ala Val Gly Ala	
195 200 205	
atg gca tat gca aag ggt cat ttt gcc aac gcc ttt ggt aca cgg tca	672
Met Ala Tyr Ala Lys Gly His Phe Ala Asn Ala Phe Gly Thr Arg Ser	

210	215	220	
aca gct gaa ggc aac tat tcc ttg gca gta ggt ctt acc gcc aaa gcc			720
Thr Ala Glu Gly Asn Tyr Ser Leu Ala Val Gly Leu Thr Ala Lys Ala			
225	230	235	240
gaa aaa gga tat aca atc gct att ggt tct aat gca caa gct atc aat			768
Glu Lys Gly Tyr Thr Ile Ala Ile Gly Ser Asn Ala Gln Ala Ile Asn			
	245	250	255
tat gga gca cta gcc ctt ggt gca gat act cga gtt gat ttg gat tac			816
Tyr Gly Ala Leu Ala Leu Gly Ala Asp Thr Arg Val Asp Leu Asp Tyr			
	260	265	270
ggt att gcc cta ggt tat ggt tct cag atc ctt aat aat aat aat aat			864
Gly Ile Ala Leu Gly Tyr Gly Ser Gln Ile Leu Asn Asn Asn Asn Asn			
	275	280	285
aat aat aat aaa gcc tat gta cca gaa ggt aat ggg tca aac ata aaa			912
Asn Asn Asn Lys Ala Tyr Val Pro Glu Gly Asn Gly Ser Asn Ile Lys			
	290	295	300
tcg tct aaa gcc acc ggc aat ggt tta ttt tcc att ggt agt agc act			960
Ser Ser Lys Ala Thr Gly Asn Gly Leu Phe Ser Ile Gly Ser Ser Thr			
305	310	315	320
atc aag cgt aaa atc atc aat gtc ggt gca ggt tat gag gat acc gat			1008
Ile Lys Arg Lys Ile Ile Asn Val Gly Ala Gly Tyr Glu Asp Thr Asp			
	325	330	335
gcg gtc aat gtg gca cag cta aaa gcg gtg gag aat ctg gct aag cgt			1056
Ala Val Asn Val Ala Gln Leu Lys Ala Val Glu Asn Leu Ala Lys Arg			
	340	345	350
caa att act ttt aag ggt gat gat aac ggt act ggc gtt aag aaa aaa			1104
Gln Ile Thr Phe Lys Gly Asp Asp Asn Gly Thr Gly Val Lys Lys Lys			
	355	360	365
ctg ggc gag act tta acc att aaa ggt ggt gag acc caa gcg gac aag			1152
Leu Gly Glu Thr Leu Thr Ile Lys Gly Gly Glu Thr Gln Ala Asp Lys			
	370	375	380
cta acc gat aat aat aac att ggt gtg gta aca gat aat aat act ggt			1200
Leu Thr Asp Asn Asn Asn Ile Gly Val Val Thr Asp Asn Asn Thr Gly			
385	390	395	400
ctg aaa gtt aaa ctt gct aaa aac cta agc ggt ctt gaa aca gtt agc			1248
Leu Lys Val Lys Leu Ala Lys Asn Leu Ser Gly Leu Glu Thr Val Ser			
	405	410	415
acc aaa aac cta acc gcc agc gag aaa gtt acg gta ggt agt ggt aat			1296
Thr Lys Asn Leu Thr Ala Ser Glu Lys Val Thr Val Gly Ser Gly Asn			
	420	425	430
aac acc gct gag cta caa agc ggt ggt tta acc ttt acc cca aca aca			1344
Asn Thr Ala Glu Leu Gln Ser Gly Gly Leu Thr Phe Thr Pro Thr Thr			
	435	440	445

aat gca agc aca gac aaa acc gtc tat ggc act gat ggg ctt aag ttt	1392
Asn Ala Ser Thr Asp Lys Thr Val Tyr Gly Thr Asp Gly Leu Lys Phe	
450 455 460	
act gat aat tct aat acg gca ctt gaa gat act act cgt atc acc aaa	1440
Thr Asp Asn Ser Asn Thr Ala Leu Glu Asp Thr Thr Arg Ile Thr Lys	
465 470 475 480	
gat aaa att ggt ttt agc aat aaa gct ggt aca gtt gat gaa aac aaa	1488
Asp Lys Ile Gly Phe Ser Asn Lys Ala Gly Thr Val Asp Glu Asn Lys	
485 490 495	
cct tat ctt gat aaa gac aag cta aaa gtt ggc aac agc acc cta aac	1536
Pro Tyr Leu Asp Lys Asp Lys Leu Lys Val Gly Asn Ser Thr Leu Asn	
500 505 510	
aac ggt ggc ttg act gtt aat aac acc att ggt ggt agc aat aaa caa	1584
Asn Gly Gly Leu Thr Val Asn Asn Thr Ile Gly Gly Ser Asn Lys Gln	
515 520 525	
atc caa gtc ggt gct gat ggc att aaa ttt gcc gat gtg aat gtt aat	1632
Ile Gln Val Gly Ala Asp Gly Ile Lys Phe Ala Asp Val Asn Val Asn	
530 535 540	
gta tca aat gcc gca aaa ttc ggc act act cgt att acc gaa gag gaa	1680
Val Ser Asn Ala Ala Lys Phe Gly Thr Thr Arg Ile Thr Glu Glu Glu	
545 550 555 560	
att ggc ttt gct gat gct gat ggt aaa gtt gat aaa aag tca cca tat	1728
Ile Gly Phe Ala Asp Ala Asp Gly Lys Val Asp Lys Lys Ser Pro Tyr	
565 570 575	
ttg gat aaa aaa caa ctt caa gtg ggt ggt gtt aaa att acc aaa gac	1776
Leu Asp Lys Lys Gln Leu Gln Val Gly Gly Val Lys Ile Thr Lys Asp	
580 585 590	
agt ggc att aat gca ggt gat caa aag atc agt aat gtt aaa gat gca	1824
Ser Gly Ile Asn Ala Gly Asp Gln Lys Ile Ser Asn Val Lys Asp Ala	
595 600 605	
acg gac gat acc gat gca gtc act tat aaa cag ctt aaa caa gtc caa	1872
Thr Asp Asp Thr Asp Ala Val Thr Tyr Lys Gln Leu Lys Gln Val Gln	
610 615 620	
caa gac gcc gac ggt gcc cta caa agc ttc tct att cgt gat gaa aaa	1920
Gln Asp Ala Asp Gly Ala Leu Gln Ser Phe Ser Ile Arg Asp Glu Lys	
625 630 635 640	
ggt cag gaa ttt acg att agt aac ttg tat tct aat ggt aat acc cca	1968
Gly Gln Glu Phe Thr Ile Ser Asn Leu Tyr Ser Asn Gly Asn Thr Pro	
645 650 655	
aat acc ttt gag acc atc acc ttt gca ggt gaa aac ggc atc agt atc	2016
Asn Thr Phe Glu Thr Ile Thr Phe Ala Gly Glu Asn Gly Ile Ser Ile	
660 665 670	

agc Ser	aat Asn	gac Asp 675	ata Ile	gcc Ala	aaa Lys	ggt Gly	aaa Lys 680	gtc Val	aaa Lys	ggt Val	ggt Gly	att Ile 685	gac Asp	cca Pro	atc Ile	2064
aat Asn	ggt Gly 690	ctc Leu	acc Thr	acg Thr	cct Pro	aag Lys 695	ctg Leu	acc Thr	gtg Val	ggt Gly	agc Ser 700	gat Asp	aaa Lys	gat Asp	ggt Gly	2112
aaa Lys 705	act Thr	caa Gln	ttg Leu	gtt Val	att Ile 710	gag Glu	caa Gln	gtg Val	gct Ala	agc Ser 715	ggt Gly	aac Asn	gac Asp	acc Thr	aaa Lys 720	2160
aac Asn	atc Ile	att Ile	aga Arg	gga Gly 725	ttg Leu	tcc Ser	cca Pro	aca Thr	ctg Leu 730	cct Pro	agc Ser	att Ile	acc Thr	aat Asn	gca Ala 735	2208
ggt Gly	ggc Gly	gta Val	cgc Arg 740	acc Thr	aca Thr	gaa Glu	cag Gln	ggc Gly 745	aat Asn	aca Thr	atc Ile	acc Thr	agc Ser 750	gac Asp	gaa Glu	2256
gac Asp	aaa Lys 755	tcc Ser	aaa Lys	gcc Ala	gcc Ala	agt Ser	atc Ile 760	ggt Gly	gat Asp	ata Ile	tta Leu 765	aat Asn	aca Thr	ggc Gly	ttt Phe	2304
aac Asn 770	cta Leu	aaa Lys	aat Asn	aat Asn	agc Ser	aac Asn 775	tcc Ser	gtt Val	ggc Gly	ttt Phe 780	gtc Val	tcc Ser	act Thr	tat Tyr	aac Asn	2352
act Thr 785	gtt Val	gac Asp	ttt Phe	atc Ile	gat Asp 790	ggc Gly	aat Asn	gcc Ala	acc Thr	acc Thr	gct Ala 795	aag Lys	gta Val	act Thr	tac Tyr 800	2400
gat Asp	gaa Glu	acc Thr	aat Asn	caa Gln 805	acc Thr	agt Ser	aaa Lys	gta Val	act Thr	tat Tyr 810	gat Asp	gtc Val	aat Asn	gtg Val 815	gat Asp	2448
gag Glu	aaa Lys	acc Thr	att Ile 820	gaa Glu	ctc Leu	aca Thr	ggc Gly	gat Asp 825	aat Asn	ggc Gly	aag Lys	aca Thr	aac Asn	aaa Lys 830	att Ile	2496
ggc Gly	gtc Val 835	aaa Lys	acc Thr	acc Thr	aca Thr	ctg Leu 840	acc Thr	aca Thr	aca Thr	aat Asn	gct Ala 845	aat Asn	ggt Gly	aaa Lys	gca Ala	2544
acc Thr 850	aac Asn	ttt Phe	agt Ser	acc Thr	acc Thr	gat Asp 855	aac Asn	gat Asp	gcc Ala	ctt Leu	ggt Val 860	aac Asn	gcc Ala	aaa Lys	gac Asp	2592
atc Ile 865	gcc Ala	gaa Glu	aat Asn	cta Leu	aac Asn 870	acc Thr	cta Leu	gcc Ala	aag Lys	gaa Glu 875	att Ile	cac His	acc Thr	acc Thr	aaa Lys 880	2640
ggc Gly	aca Thr	gca Ala	gac Asp	acc Thr 885	gcc Ala	cta Leu	caa Gln	acc Thr	ttt Phe 890	aaa Lys	gtc Val	aaa Lys	aaa Lys	gac Asp 895	ggt Gly	2688
qca	act	gat	gac	gaa	acc	atc	acc	gtg	ggt	aaa	gat	ggt	aca	caa	aac	2736

agc Ser	aat Asn	gac Asp 675	ata Ile	gcc Ala	aaa Lys	ggg Gly	aaa Lys 680	gtc Val	aaa Lys	gtt Val	ggg Gly	att Ile 685	gac Asp	cca Pro	atc Ile	2064
aat Asn	ggg Gly 690	ctc Leu	acc Thr	acg Thr	cct Pro	aag Lys 695	ctg Leu	acc Thr	gtg Val	ggg Gly	agc Ser 700	gat Asp	aaa Lys	gat Asp	ggg Gly	2112
aaa Lys 705	act Thr	caa Gln	ttg Leu	gtt Val	att Ile 710	gag Glu	caa Gln	gtg Val	gct Ala	agc Ser 715	ggg Gly	aac Asn	gac Asp	acc Thr	aaa Lys 720	2160
aac Asn	atc Ile	att Ile	aga Arg	gga Gly 725	ttg Leu	tcc Ser	cca Pro	aca Thr	ctg Leu 730	cct Pro	agc Ser	att Ile	acc Thr	aat Asn 735	gca Ala	2208
ggg Gly	ggc Gly	gta Val	cgc Arg	acc Thr	aca Thr	gaa Glu	cag Gln	ggc Gly	aat Asn	aca Thr	atc Ile	acc Thr	agc Ser	gac Asp	gaa Glu	2256
gac Asp	aaa Lys 755	tcc Ser	aaa Lys	gcc Ala	gcc Ala	agt Ser	atc Ile 760	ggg Gly	gat Asp	ata Ile	tta Leu	aat Asn 765	aca Thr	ggc Gly	ttt Phe	2304
aac Asn 770	cta Leu	aaa Lys	aat Asn	aat Asn	agc Ser	aac Asn 775	tcc Ser	gtt Val	ggc Gly	ttt Phe	gtc Val 780	tcc Ser	act Thr	tat Tyr	aac Asn	2352
act Thr 785	gtt Val	gac Asp	ttt Phe	atc Ile	gat Asp 790	ggc Gly	aat Asn	gcc Ala	acc Thr	acc Thr	gct Ala	aag Lys	gta Val	act Thr	tac Tyr 800	2400
gat Asp	gaa Glu	acc Thr	aat Asn	caa Gln	acc Thr	agt Ser	aaa Lys	gta Val	act Thr	tat Tyr	gat Asp	gtc Val	aat Asn	gtg Val	gat Asp	2448
gag Glu	aaa Lys	acc Thr	att Ile	gaa Glu	ctc Leu	aca Thr	ggc Gly	gat Asp	aat Asn	ggc Gly	aag Lys	aca Thr	aac Asn	aaa Lys	att Ile	2496
ggc Gly	gtc Val	aaa Lys 835	acc Thr	acc Thr	aca Thr	ctg Leu	acc Thr	aca Thr	aca Thr	aat Asn	gct Ala	aat Asn 845	ggg Gly	aaa Lys	gca Ala	2544
acc Thr	aac Asn 850	ttt Phe	agt Ser	acc Thr	acc Thr	gat Asp	aac Asn	gat Asp	gcc Ala	ctt Leu	gtt Val 860	aac Asn	gcc Ala	aaa Lys	gac Asp	2592
atc Ile 865	gcc Ala	gaa Glu	aat Asn	cta Leu	aac Asn	acc Thr	cta Leu	gcc Ala	aag Lys	gaa Glu	att Ile	cac His	acc Thr	acc Thr	aaa Lys 880	2640
ggc Gly	aca Thr	gca Ala	gac Asp	acc Thr	gcc Ala	cta Leu	caa Gln	acc Thr	ttt Phe	aaa Lys	gtc Val	aaa Lys	aaa Lys	gac Asp	ggg Gly	2688
gca Glu	act Thr	gat Asp	gac Thr	qaa Ala	acc Thr	atc Leu	acc Thr	gtg Val	ggg Gly	aaa Lys	gat Asp	ggg Gly	aca Thr	caa Glu	aac Thr	2736

Ala	Thr	Asp	Asp	Glu	Thr	Ile	Thr	Val	Gly	Lys	Asp	Gly	Thr	Gln	Asn	
			900					905					910			
ggc	aag	acc	gtc	aac	act	cta	aaa	ctc	aaa	ggg	gaa	aac	ggg	cta	acg	2784
Gly	Lys	Thr	Val	Asn	Thr	Leu	Lys	Leu	Lys	Gly	Glu	Asn	Gly	Leu	Thr	
		915					920					925				
gtt	gct	acc	aat	aaa	gat	ggg	acg	gtt	acc	ttt	ggc	att	aac	acc	caa	2832
Val	Ala	Thr	Asn	Lys	Asp	Gly	Thr	Val	Thr	Phe	Gly	Ile	Asn	Thr	Gln	
	930					935					940					
agc	ggg	ctt	aaa	gcc	ggc	gac	agc	acc	act	cta	aac	aaa	gat	ggc	ttg	2880
Ser	Gly	Leu	Lys	Ala	Gly	Asp	Ser	Thr	Thr	Leu	Asn	Lys	Asp	Gly	Leu	
945					950					955					960	
tct	att	aaa	aac	ccc	gct	agt	aac	gaa	caa	atc	caa	gtc	ggg	gct	gat	2928
Ser	Ile	Lys	Asn	Pro	Ala	Ser	Asn	Glu	Gln	Ile	Gln	Val	Gly	Ala	Asp	
			965						970					975		
ggc	gtg	aag	ttt	gcc	aag	gtt	gat	aag	ggg	aat	tca	agc	act	ggc	att	2976
Gly	Val	Lys	Phe	Ala	Lys	Val	Asp	Lys	Gly	Asn	Ser	Ser	Thr	Gly	Ile	
		980					985						990			
gat	ggc	aca	agc	cgt	atc	acc	aaa	gat	caa	att	ggc	ttt	act	ggg	gct	3024
Asp	Gly	Thr	Ser	Arg	Ile	Thr	Lys	Asp	Gln	Ile	Gly	Phe	Thr	Gly	Ala	
		995					1000					1005				
aat	ggc	tca	ctt	gat	acc	acc	aaa	ccc	cac	cta	acc	aaa	gac	aag	ctt	3072
Asn	Gly	Ser	Leu	Asp	Thr	Thr	Lys	Pro	His	Leu	Thr	Lys	Asp	Lys	Leu	
	1010					1015					1020					
aaa	gtg	ggg	gaa	gtt	gaa	att	acc	aac	act	ggc	att	aac	gca	ggg	ggg	3120
Lys	Val	Gly	Glu	Val	Glu	Ile	Thr	Asn	Thr	Gly	Ile	Asn	Ala	Gly	Gly	
1025					1030					1035					1040	
aaa	aag	att	acc	aac	att	caa	tca	ggg	gat	att	acc	caa	aac	agc	aat	3168
Lys	Lys	Ile	Thr	Asn	Ile	Gln	Ser	Gly	Asp	Ile	Thr	Gln	Asn	Ser	Asn	
			1045					1050					1055			
gat	gct	gtg	aca	ggc	ggg	cgg	gtt	tat	gat	tta	aaa	acc	gaa	ctt	gaa	3216
Asp	Ala	Val	Thr	Gly	Gly	Arg	Val	Tyr	Asp	Leu	Lys	Thr	Glu	Leu	Glu	
		1060					1065						1070			
agc	aaa	atc	aac	agt	gct	gct	aaa	aca	gca	caa	aac	tca	tta	cac	gaa	3264
Ser	Lys	Ile	Asn	Ser	Ala	Ala	Lys	Thr	Ala	Gln	Asn	Ser	Leu	His	Glu	
		1075					1080					1085				
ttc	tca	gta	gca	gat	gaa	caa	ggg	aat	cac	ttt	acg	gtt	agt	aac	cct	3312
Phe	Ser	Val	Ala	Asp	Glu	Gln	Gly	Asn	His	Phe	Thr	Val	Ser	Asn	Pro	
	1090					1095					1100					
tac	tcc	agt	tat	gac	acc	tca	aag	acc	tct	gat	gtc	atc	acc	ttt	gca	3360
Tyr	Ser	Ser	Tyr	Asp	Thr	Ser	Lys	Thr	Ser	Asp	Val	Ile	Thr	Phe	Ala	
1105					1110					1115					1120	
ggg	gaa	aac	ggc	att	acc	acc	aag	gta	aat	aaa	ggg	gtg	gtg	cgt	gtg	3408
Gly	Glu	Asn	Gly	Ile	Thr	Thr	Lys	Val	Asn	Lys	Gly	Val	Val	Arg	Val	

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1125	1130	1135	
ggc att gac caa acc aaa ggc tta acc acg cct aag ctg acc gtg ggt Gly Ile Asp Gln Thr Lys Gly Leu Thr Thr Pro Lys Leu Thr Val Gly 1140 1145 1150			3456
aat aat aat ggc aaa ggc att gtc att gac agt aaa gat ggt caa aat Asn Asn Asn Gly Lys Gly Ile Val Ile Asp Ser Lys Asp Gly Gln Asn 1155 1160 1165			3504
acc atc aca gga cta agc aac act cta gct aat gtt acc aat gat ggt Thr Ile Thr Gly Leu Ser Asn Thr Leu Ala Asn Val Thr Asn Asp Gly 1170 1175 1180			3552
gca gga cac gca cta agc caa ggg ctt gcc aat gac acc gac aaa acc Ala Gly His Ala Leu Ser Gln Gly Leu Ala Asn Asp Thr Asp Lys Thr 1185 1190 1195 1200			3600
cgt gcc gcc agc att ggt gat gtg cta aac gca ggc ttt aac ttg caa Arg Ala Ala Ser Ile Gly Asp Val Leu Asn Ala Gly Phe Asn Leu Gln 1205 1210 1215			3648
ggc aat ggt gaa gcg gtt gac ttt gtc tcc act tat gac act gtt gac Gly Asn Gly Glu Ala Val Asp Phe Val Ser Thr Tyr Asp Thr Val Asp 1220 1225 1230			3696
ttt atc gat ggc aat gcc acc acc gct aag gtg acc tat gat gac aca Phe Ile Asp Gly Asn Ala Thr Thr Ala Lys Val Thr Tyr Asp Asp Thr 1235 1240 1245			3744
agc aaa acc agt aaa gtg gtc tat gat gtc aat gtg gat aat aaa acc Ser Lys Thr Ser Lys Val Val Tyr Asp Val Asn Val Asp Asn Lys Thr 1250 1255 1260			3792
att gaa gtg aca agt gat aaa aaa ctt ggc gtc aaa acc acc aca ctg Ile Glu Val Thr Ser Asp Lys Lys Leu Gly Val Lys Thr Thr Thr Leu 1265 1270 1275 1280			3840
acc aaa aca agt gct aat ggt aat gca acc aaa ttt agt gcc gcc gat Thr Lys Thr Ser Ala Asn Gly Asn Ala Thr Lys Phe Ser Ala Ala Asp 1285 1290 1295			3888
ggc gat gcc ctt gtt aaa gcc agt gat atc gcc acc cat cta aat acc Gly Asp Ala Leu Val Lys Ala Ser Asp Ile Ala Thr His Leu Asn Thr 1300 1305 1310			3936
ttg gct ggc gac atc caa acc gcc aaa ggg gca agc caa gca agc agc Leu Ala Gly Asp Ile Gln Thr Ala Lys Gly Ala Ser Gln Ala Ser Ser 1315 1320 1325			3984
tca gca agc tat gtg gat gct gat ggc aac aag gtc atc tat gac agt Ser Ala Ser Tyr Val Asp Ala Asp Gly Asn Lys Val Ile Tyr Asp Ser 1330 1335 1340			4032
acc gat aag aag tac tat caa gtc aat gac aag ggt caa gtg gac aaa Thr Asp Lys Lys Tyr Tyr Gln Val Asn Asp Lys Gly Gln Val Asp Lys 1345 1350 1355 1360			4080

aac Asn	aaa Lys	gaa Glu	gtt Val	gcc Ala	aaa Lys	gac Asp	aaa Lys	ctg Leu	gtc Val	gcc Ala	caa Gln	gcc Ala	caa Gln	acc Thr	cca Pro	4128
				1365					1370					1375		
gat Asp	ggc Gly	aca Thr	ttg Leu	gct Ala	caa Gln	atg Met	aat Asn	gtc Val	aaa Lys	tca Ser	gtc Val	att Ile	aac Asn	aaa Lys	gag Glu	4176
				1380					1385					1390		
caa Gln	gta Val	aat Asn	gat Asp	gcc Ala	aat Asn	aaa Lys	aag Lys	caa Gln	ggc Gly	atc Ile	aat Asn	gaa Glu	gac Asp	aac Asn	gcc Ala	4224
				1395					1400					1405		
ttt Phe	atc Ile	aaa Lys	ggg Gly	ctt Leu	gaa Glu	aac Asn	gcc Ala	gcc Ala	aaa Lys	gac Asp	acc Thr	aaa Lys	acc Thr	aaa Lys	aac Asn	4272
				1410					1415					1420		
gcc Ala	gca Ala	gta Val	act Thr	gtg Val	ggg Gly	gat Asp	tta Leu	aat Asn	gcc Ala	ggt Val	gcc Ala	caa Gln	aca Thr	ccg Pro	ctg Leu	4320
				1425					1430					1435		
acc Thr	ttt Phe	gca Ala	ggg Gly	gat Asp	aca Thr	ggc Gly	aca Thr	acg Thr	gct Ala	aaa Lys	aaa Lys	ctg Leu	ggc Gly	gag Glu	act Thr	4368
				1445					1450					1455		
ttg Leu	acc Thr	atc Ile	aaa Lys	ggg Gly	ggg Gly	caa Gln	aca Thr	gac Asp	acc Thr	aat Asn	aag Lys	cta Leu	acc Thr	gat Asp	aat Asn	4416
				1460					1465					1470		
aac Asn	atc Ile	ggt Gly	gtg Val	gta Val	gca Ala	ggg Gly	act Thr	gat Asp	ggc Gly	ttc Phe	act Thr	gtc Val	aaa Lys	ctt Leu	gcc Ala	4464
				1475					1480					1485		
aaa Lys	gac Asp	cta Leu	acc Thr	aat Asn	ctt Leu	aac Asn	agc Ser	ggt Val	aat Asn	gca Ala	ggt Gly	ggc Gly	acc Thr	aga Arg	att Ile	4512
				1490					1495					1500		
gat Asp	gaa Glu	aaa Lys	ggc Gly	atc Ile	tct Ser	ttt Phe	gta Val	gac Asp	gca Ala	aac Asn	ggt Gly	caa Gln	gcc Ala	aaa Lys	gca Ala	4560
				1505					1510					1515		
aac Asn	acc Thr	cct Pro	gtg Val	cta Leu	agt Ser	gcc Ala	aat Asn	ggg Gly	ctg Leu	gac Asp	ctg Leu	ggt Gly	ggc Gly	aaa Lys	cgc Arg	4608
				1525					1530					1535		
atc Ile	agt Ser	aac Asn	atc Ile	ggg Gly	gca Ala	gct Ala	ggt Val	gat Asp	gat Asp	aac Asn	gat Asp	gcg Ala	gtg Val	aac Asn	ttt Phe	4656
				1540					1545					1550		
aag Lys	cag Gln	ttt Phe	aat Asn	gaa Glu	gtt Val	gcc Ala	aaa Lys	acg Thr	gtc Val	aac Asn	aac Asn	cta Leu	aac Asn	aac Asn	caa Gln	4704
				1555					1560					1565		
agt Ser	aac Asn	tca Ser	ggg Gly	gcg Ala	tca Ser	tta Leu	ccc Pro	ttt Phe	gtg Val	gta Val	acc Thr	gat Asp	gcc Ala	aat Asn	ggc Gly	4752
				1570					1575					1580		

Thr Gly Asp Ala Val Ala Leu Asn Asn Leu Ser Lys Ala Val Phe Lys	
1810 1815 1820	
tcc aaa gat ggt aca act act acc aca gta agc tct gat ggc atc agt	5520
Ser Lys Asp Gly Thr Thr Thr Thr Thr Val Ser Ser Asp Gly Ile Ser	
1825 1830 1835 1840	
atc caa ggc aaa gat aac agc agc atc acc cta agc aaa gat ggg ctg	5568
Ile Gln Gly Lys Asp Asn Ser Ser Ile Thr Leu Ser Lys Asp Gly Leu	
1845 1850 1855	
aat gta ggc ggt aag gtc atc agc aat gtg ggt aaa ggc aca aaa gac	5616
Asn Val Gly Gly Lys Val Ile Ser Asn Val Gly Lys Gly Thr Lys Asp	
1860 1865 1870	
acc gac gct gcc aat gta caa cag tta aac gaa gta cgc aac ttg ttg	5664
Thr Asp Ala Ala Asn Val Gln Gln Leu Asn Glu Val Arg Asn Leu Leu	
1875 1880 1885	
ggc ctt ggt aat gct ggt aat gat aac gct gac ggc aat cag gta aac	5712
Gly Leu Gly Asn Ala Gly Asn Asp Asn Ala Asp Gly Asn Gln Val Asn	
1890 1895 1900	
att gcc gac atc aaa aaa gac cca aat tca ggt tca tca tct aac cgc	5760
Ile Ala Asp Ile Lys Lys Asp Pro Asn Ser Gly Ser Ser Ser Asn Arg	
1905 1910 1915 1920	
act gtc atc aaa gca ggc acg gta ctt ggc ggt aaa ggt aat aac gat	5808
Thr Val Ile Lys Ala Gly Thr Val Leu Gly Gly Lys Gly Asn Asn Asp	
1925 1930 1935	
acc gaa aaa ctt gcc act ggt ggt gta caa gtg ggc gtg gat aaa gac	5856
Thr Glu Lys Leu Ala Thr Gly Gly Val Gln Val Gly Val Asp Lys Asp	
1940 1945 1950	
ggc aac gct aac ggc gat tta agc aat gtt tgg gtc aaa acc caa aaa	5904
Gly Asn Ala Asn Gly Asp Leu Ser Asn Val Trp Val Lys Thr Gln Lys	
1955 1960 1965	
gat ggc agc aaa aaa gcc ctg ctc gcc act tat aac gcc gca ggt cag	5952
Asp Gly Ser Lys Lys Ala Leu Leu Ala Thr Tyr Asn Ala Ala Gly Gln	
1970 1975 1980	
acc aac tat ttg acc aac aac ccc gca gaa gcc att gac aga ata aat	6000
Thr Asn Tyr Leu Thr Asn Asn Pro Ala Glu Ala Ile Asp Arg Ile Asn	
1985 1990 1995 2000	
gaa caa ggt atc cgc ttc ttc cat gtc aac gat ggc aat caa gag cct	6048
Glu Gln Gly Ile Arg Phe Phe His Val Asn Asp Gly Asn Gln Glu Pro	
2005 2010 2015	
gtg gta caa ggg cgt aac ggc att gac tca agt gcc tca ggc aag cac	6096
Val Val Gln Gly Arg Asn Gly Ile Asp Ser Ser Ala Ser Gly Lys His	
2020 2025 2030	
tca gtg gcg ata ggt ttc cag gcc aag gca gat ggt gaa gcc gcc gtt	6144
Ser Val Ala Ile Gly Phe Gln Ala Lys Ala Asp Gly Glu Ala Ala Val	

2035	2040	2045	
gcc ata ggc aga caa acc caa gca ggc aac caa tcc atc gcc atc ggt Ala Ile Gly Arg Gln Thr Gln Ala Gly Asn Gln Ser Ile Ala Ile Gly 2050 2055 2060			6192
gat aac gca caa gcc acg ggc gat caa tcc atc gcc atc ggt aca ggc Asp Asn Ala Gln Ala Thr Gly Asp Gln Ser Ile Ala Ile Gly Thr Gly 2065 2070 2075 2080			6240
aat gtg gta aca ggt aag cac tct ggt gcc atc ggc gac cca agc act Asn Val Val Thr Gly Lys His Ser Gly Ala Ile Gly Asp Pro Ser Thr 2085 2090 2095			6288
gtt aag gct gat aac agt tac agt gtg ggt aat aac aac cag ttt atc Val Lys Ala Asp Asn Ser Tyr Ser Val Gly Asn Asn Asn Gln Phe Ile 2100 2105 2110			6336
gat gcc act cag acc gat gtc ttt ggt gtg ggc aat aac atc acc gtg Asp Ala Thr Gln Thr Asp Val Phe Gly Val Gly Asn Asn Ile Thr Val 2115 2120 2125			6384
acc gaa agt aac tcg gtt gcc tta ggt tca aac tct gcc atc agt gca Thr Glu Ser Asn Ser Val Ala Leu Gly Ser Asn Ser Ala Ile Ser Ala 2130 2135 2140			6432
ggc aca cac gca ggc aca caa gcc aaa aaa tct gac ggc aca gca ggt Gly Thr His Ala Gly Thr Gln Ala Lys Lys Ser Asp Gly Thr Ala Gly 2145 2150 2155 2160			6480
aca acc acc aca gca ggt gca aca ggt acg gtt aaa ggc ttt gct gga Thr Thr Thr Thr Ala Gly Ala Thr Gly Thr Val Lys Gly Phe Ala Gly 2165 2170 2175			6528
caa acg gcg gtt ggt gcg gtc tcc gtg ggt gcc tca ggt gct gaa cgc Gln Thr Ala Val Gly Ala Val Ser Val Gly Ala Ser Gly Ala Glu Arg 2180 2185 2190			6576
cgt atc caa aat gtg gca gca ggt gag gtc agt gcc acc agc acc gat Arg Ile Gln Asn Val Ala Ala Gly Glu Val Ser Ala Thr Ser Thr Asp 2195 2200 2205			6624
gcg gtc aat ggt agc cag ttg tac aaa gcc acc caa ggc att gcc aac Ala Val Asn Gly Ser Gln Leu Tyr Lys Ala Thr Gln Gly Ile Ala Asn 2210 2215 2220			6672
gca acc aat gag ctt gac cat cgt atc cac caa aac gaa aat aaa gcc Ala Thr Asn Glu Leu Asp His Arg Ile His Gln Asn Glu Asn Lys Ala 2225 2230 2235 2240			6720
aat gca ggg att tca tca gcg atg gcg atg gcg tcc atg cca caa gcc Asn Ala Gly Ile Ser Ser Ala Met Ala Met Ala Ser Met Pro Gln Ala 2245 2250 2255			6768
tac att cct ggc aga tcc atg gtt acc ggg ggt att gcc acc cac aac Tyr Ile Pro Gly Arg Ser Met Val Thr Gly Gly Ile Ala Thr His Asn 2260 2265 2270			6816

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[illegible]

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Q8
LES-1

[illegible][illegible][illegible][illegible]

1110	1120	1130	1140	1150	1160	1170	1180	1190	1200
TTNIQSGEIAQNSHDVATGGKIYDLKTELENKISSAKTAQNSLHEFSVADEQGNFTVSNPYSSYDTSKTSDVITFAGENGITTKVNKGVVVRVGIDQTKG									
.....K.....									

1210	1220	1230	1240	1250	1260	1270	1280	1290	1300
LTTPKLTVGNNNGKGI	VIDSONGONTITGL	SNTLANVTNDKGS	VRTTEOGNIIKDE	DKTRAASI	VDVLSAGEN	LOGNCEAV	DEVSTYD	TVNFAD	GNAATTA
									4223

4223
Q8
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Q8
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Q8
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FIGURE 7

Construction of Plasmids Expressing Portions of the 200 kDa Protein Gene from Strain 4223

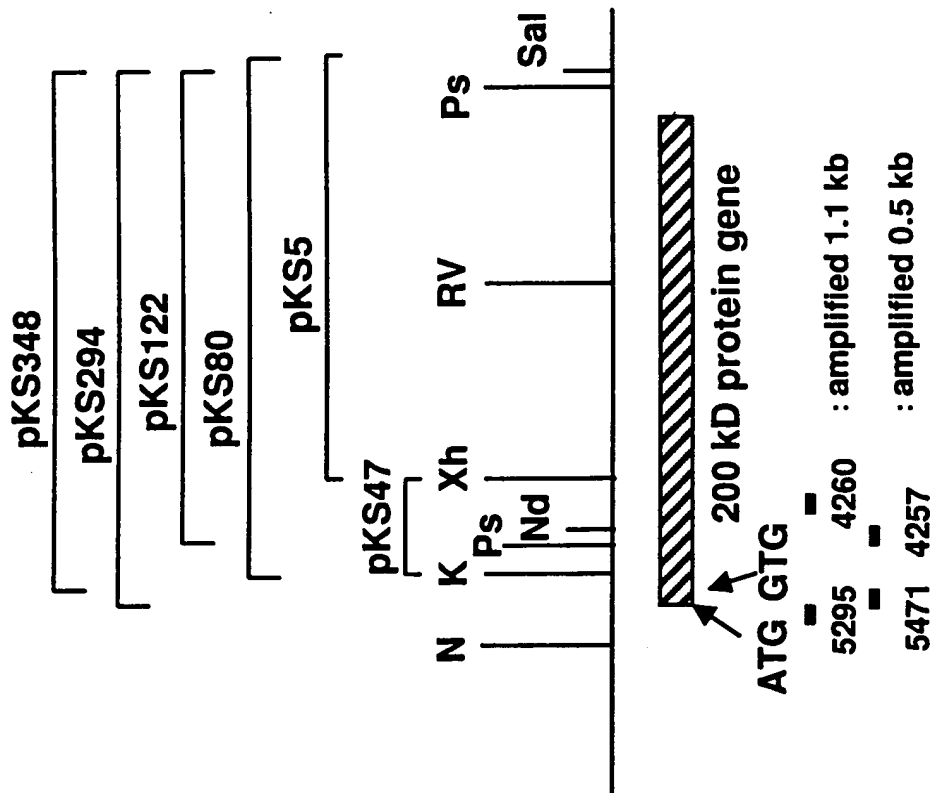


Figure 8. *M. catarrhalis* M56 200kDa gene in pKS348.

ATG atc ggt gca acg ctc agt ggc agt gct tat gct caa aaa aaa gat	48
Met Ile Gly Ala Thr Leu Ser Gly Ser Ala Tyr Ala Gln Lys Lys Asp	
1 5 10 15	
acc aaa cat atc gca att ggt gaa caa aac cag cca aga cgc tca ggc	96
Thr Lys His Ile Ala Ile Gly Glu Gln Asn Gln Pro Arg Arg Ser Gly	
20 25 30	
act gcc aag gcg gac ggt gat cga gcc att gct att ggt gaa aat gct	144
Thr Ala Lys Ala Asp Gly Asp Arg Ala Ile Ala Ile Gly Glu Asn Ala	
35 40 45	
aac gca cag ggc ggt caa gcc atc gcc atc ggt agt agt aat aaa act	192
Asn Ala Gln Gly Gly Gln Ala Ile Ala Ile Gly Ser Ser Asn Lys Thr	
50 55 60	
gtc aat gga agc agt ttg gat aag ata ggt acc gat gct acg ggt caa	240
Val Asn Gly Ser Ser Leu Asp Lys Ile Gly Thr Asp Ala Thr Gly Gln	
65 70 75 80	
gag tcc atc gcc atc ggt ggt gat gta aag gct agt ggt gat gcc tcg	288
Glu Ser Ile Ala Ile Gly Gly Asp Val Lys Ala Ser Gly Asp Ala Ser	
85 90 95	
att gcc atc ggt agt gat gac tta cat ttg ctt gat cag cat ggt aat	336
Ile Ala Ile Gly Ser Asp Asp Leu His Leu Leu Asp Gln His Gly Asn	
100 105 110	
cct aaa cat ccg aaa ggt act ctg att aac gat ctt att aac ggc cat	384
Pro Lys His Pro Lys Gly Thr Leu Ile Asn Asp Leu Ile Asn Gly His	
115 120 125	
gca gta tta aaa gaa ata cga agc tca aag gat aat gat gta aaa tat	432
Ala Val Leu Lys Glu Ile Arg Ser Ser Lys Asp Asn Asp Val Lys Tyr	
130 135 140	
aga cgc aca acc gca agc gga cac gcc agt act gca gtg gga gcc atg	480
Arg Arg Thr Thr Ala Ser Gly His Ala Ser Thr Ala Val Gly Ala Met	
145 150 155 160	
tca tat gca cag ggt cat ttt tcc aac gcc ttt ggt aca cgg gca aca	528
Ser Tyr Ala Gln Gly His Phe Ser Asn Ala Phe Gly Thr Arg Ala Thr	
165 170 175	
gct aaa agt gcc tat tcc ttg gca gtg ggt ctt gcc gcc aca gcc gag	576
Ala Lys Ser Ala Tyr Ser Leu Ala Val Gly Leu Ala Ala Thr Ala Glu	
180 185 190	
ggc caa tct aca atc gct att ggt tct gat gca aca tct agc tcg ttg	624
Gly Gln Ser Thr Ile Ala Ile Gly Ser Asp Ala Thr Ser Ser Ser Leu	
195 200 205	
gga gcg ata gcc ctt ggt gca ggt act cgt gct cag cta cag ggc agt	672
Gly Ala Ile Ala Leu Gly Ala Gly Thr Arg Ala Gln Leu Gln Gly Ser	

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210	215	220	
att gcc cta ggt caa ggt tct gtt gtc act cag agt gat aat aat tct			720
Ile Ala Leu Gly Gln Gly Ser Val Val Thr Gln Ser Asp Asn Asn Ser			
225	230	235	240
aga ccg gcc tat aca cca aat acc cag gca cta gac ccc aag ttt caa			768
Arg Pro Ala Tyr Thr Pro Asn Thr Gln Ala Leu Asp Pro Lys Phe Gln			
	245	250	255
gcc acc aat aat acg aag gcg ggt cca ctt tcc att ggt agt aac tct			816
Ala Thr Asn Asn Thr Lys Ala Gly Pro Leu Ser Ile Gly Ser Asn Ser			
	260	265	270
atc aaa cgt aaa atc atc aat gtc ggt gca ggt gtt aat aaa acc gat			864
Ile Lys Arg Lys Ile Ile Asn Val Gly Ala Gly Val Asn Lys Thr Asp			
	275	280	285
gcg gtc aat gtg gca cag cta gaa gcg gtg gtg aag tgg gct aag gag			912
Ala Val Asn Val Ala Gln Leu Glu Ala Val Val Lys Trp Ala Lys Glu			
	290	295	300
cgt aga att act ttt cag ggt gat gat aac agt act gac gta aaa ata			960
Arg Arg Ile Thr Phe Gln Gly Asp Asp Asn Ser Thr Asp Val Lys Ile			
305	310	315	320
ggt ttg gat aat act tta act att aaa ggt ggt gca gag acc aac gca			1008
Gly Leu Asp Asn Thr Leu Thr Ile Lys Gly Gly Ala Glu Thr Asn Ala			
	325	330	335
tta acc gat aat aat atc ggt gtg gta aaa gag gct gat aat agt ggt			1056
Leu Thr Asp Asn Asn Ile Gly Val Val Lys Glu Ala Asp Asn Ser Gly			
	340	345	350
ctg aaa gtt aaa ctt gct aaa act tta aac aat ctt act gag gtg aat			1104
Leu Lys Val Lys Leu Ala Lys Thr Leu Asn Asn Leu Thr Glu Val Asn			
	355	360	365
aca act aca tta aat gcc aca acc aca gtt aag gta ggt agt agt agt			1152
Thr Thr Thr Leu Asn Ala Thr Thr Thr Val Lys Val Gly Ser Ser Ser			
	370	375	380
agt act aca gct gaa tta ttg agt gat agt tta acc ttt acc cag ccc			1200
Ser Thr Thr Ala Glu Leu Leu Ser Asp Ser Leu Thr Phe Thr Gln Pro			
385	390	395	400
aat aca ggc agt caa agc aca agc aaa acc gtc tat ggc gtt aat ggg			1248
Asn Thr Gly Ser Gln Ser Thr Ser Lys Thr Val Tyr Gly Val Asn Gly			
	405	410	415
gtg aag ttt act aat aat gca gaa aca aca gca gca atc ggc act act			1296
Val Lys Phe Thr Asn Asn Ala Glu Thr Thr Ala Ala Ile Gly Thr Thr			
	420	425	430
cgt att acc aga gat aaa att ggc ttt gct cga gat ggt gat gtt gat			1344
Arg Ile Thr Arg Asp Lys Ile Gly Phe Ala Arg Asp Gly Asp Val Asp			
	435	440	445

gaa Glu	aaa Lys	caa Gln	gca Ala	cca Pro	tat Tyr	ttg Leu	gat Asp	aaa Lys	aaa Lys	caa Gln	ctt Leu	aaa Lys	gtg Val	ggg Gly	agt Ser	1392
450455460																
ggt Val	gca Ala	att Ile	acc Thr	ata Ile	gac Asp	aat Asn	ggc Gly	att Ile	gat Asp	gca Ala	ggg Gly	aat Asn	aaa Lys	aag Lys	atc Ile	1440
465470475480																
agt Ser	aat Asn	ctt Leu	gcc Ala	aaa Lys	ggg Gly	agc Ser	agt Ser	gct Ala	aac Asn	gat Asp	gcg Ala	ggt Val	acc Thr	atc Ile	gaa Glu	1488
485490495																
cag Gln	ctc Leu	aaa Lys	gcc Ala	gcc Ala	aag Lys	cct Pro	act Thr	tta Leu	aac Asn	gca Ala	ggc Gly	gct Ala	ggc Gly	atc Ile	agt Ser	1536
500505510																
gtc Val	aca Thr	cct Pro	act Thr	gaa Glu	ata Ile	tca Ser	gtt Val	gat Asp	gct Ala	aag Lys	agt Ser	ggc Gly	aat Asn	gtt Val	acc Thr	1584
515520525																
gcc Ala	cca Pro	act Thr	tac Tyr	aac Asn	att Ile	ggc Gly	gtg Val	aaa Lys	acc Thr	acc Thr	gag Glu	ctt Leu	aac Asn	agt Ser	gat Asp	1632
530535540																
ggc Gly	act Thr	agt Ser	gat Asp	aaa Lys	ttt Phe	agt Ser	gtt Val	aag Lys	ggg Gly	agt Ser	ggg Gly	acg Thr	aac Asn	aat Asn	agc Ser	1680
545550555560																
tta Leu	gtt Val	acc Thr	gcc Ala	gaa Glu	cat His	ttg Leu	gca Ala	agc Ser	tat Tyr	cta Leu	aat Asn	gaa Glu	gtc Val	aat Asn	cga Arg	1728
565570575																
acg Thr	gct Ala	gac Asp	agt Ser	gct Ala	cta Leu	caa Gln	agc Ser	ttt Phe	acc Thr	gtt Val	aaa Lys	gaa Glu	gaa Glu	gac Asp	gat Asp	1776
580585590																
gat Asp	gac Asp	gcc Ala	aac Asn	gct Ala	atc Ile	acc Thr	gtg Val	gct Ala	aaa Lys	gat Asp	acg Thr	aca Thr	aaa Lys	aat Asn	gcc Ala	1824
595600605																
ggc Gly	gca Ala	gtc Val	agc Ser	atc Ile	tta Leu	aaa Lys	ctc Leu	aaa Lys	ggg Gly	aaa Lys	aac Asn	ggg Gly	cta Leu	acg Thr	gtt Val	1872
610615620																
gct Ala	acc Thr	aaa Lys	aaa Lys	gat Asp	ggg Gly	acg Thr	gtt Val	acc Thr	ttt Phe	ggg Gly	ctt Leu	agc Ser	caa Gln	gat Asp	agc Ser	1920
625630635640																
ggg Gly	ctg Leu	acc Thr	att Ile	ggc Gly	aaa Lys	agc Ser	acc Thr	cta Leu	aac Asn	aac Asn	gat Asp	ggc Gly	ttg Leu	act Thr	gtt Val	1968
645650655																
aaa Lys	gat Asp	acc Thr	aac Asn	gaa Glu	caa Gln	atc Ile	caa Gln	gtc Val	ggg Gly	gct Ala	aat Asn	ggc Gly	att Ile	aaa Lys	ttt Phe	2016
660665670																

act aat gtg aat ggt agt aat cca ggt act ggc att gca aat acc gct	2064
Thr Asn Val Asn Gly Ser Asn Pro Gly Thr Gly Ile Ala Asn Thr Ala	
675 680 685	
cgc att acc aga gat aaa att ggc ttt gct ggt tct gat ggt gca gtt	2112
Arg Ile Thr Arg Asp Lys Ile Gly Phe Ala Gly Ser Asp Gly Ala Val	
690 695 700	
gat aca aac aaa cct tat ctt gat caa gac aag cta caa gtt ggc aat	2160
Asp Thr Asn Lys Pro Tyr Leu Asp Gln Asp Lys Leu Gln Val Gly Asn	
705 710 715 720	
gtt aag att acc aac act ggc att aac gca ggt ggt aaa gcc atc aca	2208
Val Lys Ile Thr Asn Thr Gly Ile Asn Ala Gly Gly Lys Ala Ile Thr	
725 730 735	
ggg ctg tcc cca aca ctg cct agc att gcc gat caa agt agc cgc aac	2256
Gly Leu Ser Pro Thr Leu Pro Ser Ile Ala Asp Gln Ser Ser Arg Asn	
740 745 750	
ata gaa ctg ggc aat aca atc caa gac aaa gac aaa tcc aac gct gcc	2304
Ile Glu Leu Gly Asn Thr Ile Gln Asp Lys Asp Lys Ser Asn Ala Ala	
755 760 765	
agc att aat gat ata tta aat aca ggc ttt aac cta aaa aat aat aac	2352
Ser Ile Asn Asp Ile Leu Asn Thr Gly Phe Asn Leu Lys Asn Asn Asn	
770 775 780	
aac ccc att gac ttt gtc tcc act tat gac att gtt gac ttt gcc aat	2400
Asn Pro Ile Asp Phe Val Ser Thr Tyr Asp Ile Val Asp Phe Ala Asn	
785 790 795 800	
ggc aat gcc acc acc gcc aca gta acc cat gat acc gct aac aaa acc	2448
Gly Asn Ala Thr Thr Ala Thr Val Thr His Asp Thr Ala Asn Lys Thr	
805 810 815	
agt aaa gtg gta tat gat gtg aat gtg gat gat aca acc att cat cta	2496
Ser Lys Val Val Tyr Asp Val Asn Val Asp Asp Thr Thr Ile His Leu	
820 825 830	
aca ggc act gat gac aat aaa aaa ctt ggc gtc aaa acc acc aaa ctg	2544
Thr Gly Thr Asp Asp Asn Lys Lys Leu Gly Val Lys Thr Thr Lys Leu	
835 840 845	
aac aaa aca agt gct aat ggt aat aca gca act aac ttt aat gtt aac	2592
Asn Lys Thr Ser Ala Asn Gly Asn Thr Ala Thr Asn Phe Asn Val Asn	
850 855 860	
tct agt gat gaa gat gcc ctt gtt aac gcc aaa gac atc gcc gaa aat	2640
Ser Ser Asp Glu Asp Ala Leu Val Asn Ala Lys Asp Ile Ala Glu Asn	
865 870 875 880	
cta aac acc cta gcc aag gaa att cac acc acc aaa ggc aca gca gac	2688
Leu Asn Thr Leu Ala Lys Glu Ile His Thr Thr Lys Gly Thr Ala Asp	
885 890 895	
acc gcc cta caa acc ttt acc gtt aaa aag gta gat gaa aat aat aat	2736

Thr	Ala	Leu	Gln	Thr	Phe	Thr	Val	Lys	Lys	Val	Asp	Glu	Asn	Asn	Asn		
			900					905					910				
gct	gat	gac	gcc	aac	gcc	atc	acc	gtg	ggc	caa	aag	aac	gca	aat	aat	2784	
Ala	Asp	Asp	Ala	Asn	Ala	Ile	Thr	Val	Gly	Gln	Lys	Asn	Ala	Asn	Asn		
		915					920					925					
caa	gtc	aac	acc	cta	aca	ctc	aaa	ggc	gaa	aac	ggc	ctt	aat	att	aaa	2832	
Gln	Val	Asn	Thr	Leu	Thr	Leu	Lys	Gly	Glu	Asn	Gly	Leu	Asn	Ile	Lys		
		930				935					940						
acc	gac	aaa	aat	ggc	acg	gtt	acc	ttt	ggc	att	aac	acc	aca	agc	ggc	2880	
Thr	Asp	Lys	Asn	Gly	Thr	Val	Thr	Phe	Gly	Ile	Asn	Thr	Thr	Ser	Gly		
945					950					955					960		
ctt	aaa	gcc	ggc	aaa	agc	acc	cta	aac	gac	ggc	ggc	ttg	tct	att	aaa	2928	
Leu	Lys	Ala	Gly	Lys	Ser	Thr	Leu	Asn	Asp	Gly	Gly	Leu	Ser	Ile	Lys		
				965					970					975			
aac	ccc	act	ggc	agc	gaa	caa	atc	caa	gtc	ggc	gct	gat	ggc	gtg	aag	2976	
Asn	Pro	Thr	Gly	Ser	Glu	Gln	Ile	Gln	Val	Gly	Ala	Asp	Gly	Val	Lys		
			980					985					990				
ttt	gcc	aag	gtt	aat	aat	aat	ggc	gtt	gta	ggc	gct	ggc	att	gat	ggc	3024	
Phe	Ala	Lys	Val	Asn	Asn	Asn	Gly	Val	Val	Gly	Ala	Gly	Ile	Asp	Gly		
		995				1000						1005					
aca	act	cgc	att	acc	aga	gat	gaa	att	ggc	ttt	act	ggg	act	aat	ggc	3072	
Thr	Thr	Arg	Ile	Thr	Arg	Asp	Glu	Ile	Gly	Phe	Thr	Gly	Thr	Asn	Gly		
	1010				1015				1020								
tca	ctt	gat	aaa	agc	aaa	ccc	cac	cta	agc	aaa	gac	ggc	att	aac	gca	3120	
Ser	Leu	Asp	Lys	Ser	Lys	Pro	His	Leu	Ser	Lys	Asp	Gly	Ile	Asn	Ala		
1025				1030					1035					1040			
ggc	ggc	aaa	aag	att	acc	aac	att	caa	tca	ggc	gag	att	gcc	caa	aac	3168	
Gly	Gly	Lys	Lys	Ile	Thr	Asn	Ile	Gln	Ser	Gly	Glu	Ile	Ala	Gln	Asn		
			1045					1050				1055					
agc	cat	gat	gct	gtg	aca	ggc	ggc	aag	att	tat	gat	tta	aaa	acc	gaa	3216	
Ser	His	Asp	Ala	Val	Thr	Gly	Gly	Lys	Ile	Tyr	Asp	Leu	Lys	Thr	Glu		
		1060				1065					1070						
ctt	gaa	aac	aaa	atc	agc	agt	act	gcc	aaa	aca	gca	caa	aac	tca	tta	3264	
Leu	Glu	Asn	Lys	Ile	Ser	Ser	Thr	Ala	Lys	Thr	Ala	Gln	Asn	Ser	Leu		
	1075				1080					1085							
cac	gaa	ttc	tca	gta	gca	gat	gaa	caa	ggc	aat	aac	ttt	acg	gtt	agt	3312	
His	Glu	Phe	Ser	Val	Ala	Asp	Glu	Gln	Gly	Asn	Asn	Phe	Thr	Val	Ser		
	1090				1095				1100								
aac	cct	tac	tcc	agt	tat	gac	acc	tca	aag	acc	tct	gat	gtc	atc	acc	3360	
Asn	Pro	Tyr	Ser	Ser	Tyr	Asp	Thr	Ser	Lys	Thr	Ser	Asp	Val	Ile	Thr		
1105				1110				1115						1120			
ttt	gca	ggc	gaa	aac	ggc	att	acc	acc	aag	gta	aat	aaa	ggc	gtg	gtg	3408	
Phe	Ala	Gly	Glu	Asn	Gly	Ile	Thr	Thr	Lys	Val	Asn	Lys	Gly	Val	Val		

1125	1130	1135	
cgt gtg ggc att gac caa acc aaa ggc tta acc acg cct aag ctg acc			3456
Arg Val Gly Ile Asp Gln Thr Lys Gly Leu Thr Thr Pro Lys Leu Thr			
1140	1145	1150	
gtg ggt aat aat aat ggc aaa ggc att gtc att gac agc caa aat ggt			3504
Val Gly Asn Asn Asn Gly Lys Gly Ile Val Ile Asp Ser Gln Asn Gly			
1155	1160	1165	
caa aat acc atc aca gga cta agc aac act cta gct aat gtt acc aat			3552
Gln Asn Thr Ile Thr Gly Leu Ser Asn Thr Leu Ala Asn Val Thr Asn			
1170	1175	1180	
gat aaa ggt agc gta cgc acc aca gaa cag ggc aat ata atc aaa gac			3600
Asp Lys Gly Ser Val Arg Thr Thr Glu Gln Gly Asn Ile Ile Lys Asp			
1185	1190	1195	1200
gaa gac aaa acc cgt gcc gcc agc att gtt gat gtg cta agc gca ggc			3648
Glu Asp Lys Thr Arg Ala Ala Ser Ile Val Asp Val Leu Ser Ala Gly			
1205	1210	1215	
ttt aac ttg caa ggc aat ggt gaa gcg gtt gac ttt gtc tcc act tat			3696
Phe Asn Leu Gln Gly Asn Gly Glu Ala Val Asp Phe Val Ser Thr Tyr			
1220	1225	1230	
gac acc gtc aac ttt gcc gat ggc aat gcc acc acc gct aag gtg acc			3744
Asp Thr Val Asn Phe Ala Asp Gly Asn Ala Thr Thr Ala Lys Val Thr			
1235	1240	1245	
tat gat gac aca agc aaa acc agt aaa gtg gtc tat gat gtc aat gtg			3792
Tyr Asp Asp Thr Ser Lys Thr Ser Lys Val Val Tyr Asp Val Asn Val			
1250	1255	1260	
gat gat aca acc att gaa gtt aaa gat aaa aaa ctt ggc gta aaa acc			3840
Asp Asp Thr Thr Ile Glu Val Lys Asp Lys Lys Leu Gly Val Lys Thr			
1265	1270	1275	1280
acc aca ttg acc agt act ggc aca ggt gct aat aaa ttt gcc cta agc			3888
Thr Thr Leu Thr Ser Thr Gly Thr Gly Ala Asn Lys Phe Ala Leu Ser			
1285	1290	1295	
aat caa gct act ggc gat gcg ctt gtc aag gcc agt gat atc gtt gct			3936
Asn Gln Ala Thr Gly Asp Ala Leu Val Lys Ala Ser Asp Ile Val Ala			
1300	1305	1310	
cat cta aac acc tta tct ggc gac atc caa act gcc aaa ggg gca agc			3984
His Leu Asn Thr Leu Ser Gly Asp Ile Gln Thr Ala Lys Gly Ala Ser			
1315	1320	1325	
caa gcg aac aac tca gca ggc tat gtg gat gct gat ggc aat aag gtc			4032
Gln Ala Asn Asn Ser Ala Gly Tyr Val Asp Ala Asp Gly Asn Lys Val			
1330	1335	1340	
atc tat gac agt acc gat aac aag tac tat caa gcc aaa aat gat ggc			4080
Ile Tyr Asp Ser Thr Asp Asn Lys Tyr Tyr Gln Ala Lys Asn Asp Gly			
1345	1350	1355	1360

aca gtt gat aaa acc aaa gaa gtt gcc aaa gac aaa ctg gtc gcc caa	4128
Thr Val Asp Lys Thr Lys Glu Val Ala Lys Asp Lys Leu Val Ala Gln	
1365 1370 1375	
gcc caa acc cca gat ggc aca ttg gct caa atg aat gtc aaa tca gtc	4176
Ala Gln Thr Pro Asp Gly Thr Leu Ala Gln Met Asn Val Lys Ser Val	
1380 1385 1390	
att aac aaa gaa caa gta aat gat gcc aat aaa aag caa ggc atc aat	4224
Ile Asn Lys Glu Gln Val Asn Asp Ala Asn Lys Lys Gln Gly Ile Asn	
1395 1400 1405	
gaa gac aac gcc ttt gtt aaa gga ctt gaa aaa gcc gct tct gat aac	4272
Glu Asp Asn Ala Phe Val Lys Gly Leu Glu Lys Ala Ala Ser Asp Asn	
1410 1415 1420	
aaa acc aaa aac gcc gca gta act gtg ggt gat tta aat gcc gtt gcc	4320
Lys Thr Lys Asn Ala Ala Val Thr Val Gly Asp Leu Asn Ala Val Ala	
1425 1430 1435 1440	
caa aca ccg ctg acc ttt gca ggg gat aca ggc aca acg gct aaa aaa	4368
Gln Thr Pro Leu Thr Phe Ala Gly Asp Thr Gly Thr Thr Ala Lys Lys	
1445 1450 1455	
ctg ggc gag act ttg acc atc aaa ggt ggg caa aca gac acc aat aag	4416
Leu Gly Glu Thr Leu Thr Ile Lys Gly Gly Gln Thr Asp Thr Asn Lys	
1460 1465 1470	
cta acc gat aat aac atc ggt gtg gta gca ggt act gat ggc ttc act	4464
Leu Thr Asp Asn Asn Ile Gly Val Val Ala Gly Thr Asp Gly Phe Thr	
1475 1480 1485	
gtc aaa ctt gcc aaa gac cta acc aat ctt aac agc gtt aat gca ggt	4512
Val Lys Leu Ala Lys Asp Leu Thr Asn Leu Asn Ser Val Asn Ala Gly	
1490 1495 1500	
ggc acc aaa att gat gac aaa ggc gtg tct ttt gta gac tca agc ggt	4560
Gly Thr Lys Ile Asp Asp Lys Gly Val Ser Phe Val Asp Ser Ser Gly	
1505 1510 1515 1520	
caa gcc aaa gca aac acc cct gtg cta agt gcc aat ggg ctg gac ctg	4608
Gln Ala Lys Ala Asn Thr Pro Val Leu Ser Ala Asn Gly Leu Asp Leu	
1525 1530 1535	
ggg ggc aag gtc atc agt aat gtg ggc aaa ggc aca aaa gat acc gac	4656
Gly Gly Lys Val Ile Ser Asn Val Gly Lys Gly Thr Lys Asp Thr Asp	
1540 1545 1550	
gct gcc aat gta caa cag tta aac gaa gta cgc aac ttg ttg ggt ctt	4704
Ala Ala Asn Val Gln Gln Leu Asn Glu Val Arg Asn Leu Leu Gly Leu	
1555 1560 1565	
ggg aat gct ggt aat gat aac gct gac ggc aat cag gta aac att gcc	4752
Gly Asn Ala Gly Asn Asp Asn Ala Asp Gly Asn Gln Val Asn Ile Ala	
1570 1575 1580	

gac atc aaa aaa gac cca aat tca ggt tca tca tct aac cgc act gtc	4800
Asp Ile Lys Lys Asp Pro Asn Ser Gly Ser Ser Ser Asn Arg Thr Val	
1585 1590 1595 1600	
atc aaa gca ggc acg gta ctt ggc ggt aaa ggt aat aac gat acc gaa	4848
Ile Lys Ala Gly Thr Val Leu Gly Gly Lys Gly Asn Asn Asp Thr Glu	
1605 1610 1615	
aaa ctt gcc act ggt ggt ata caa gtg ggc gtg gat aaa gac ggc aac	4896
Lys Leu Ala Thr Gly Gly Ile Gln Val Gly Val Asp Lys Asp Gly Asn	
1620 1625 1630	
gct aac ggc gat tta agc aat gtt tgg gtc aaa acc caa aaa gat ggc	4944
Ala Asn Gly Asp Leu Ser Asn Val Trp Val Lys Thr Gln Lys Asp Gly	
1635 1640 1645	
agc aaa aaa gcc ctg ctc gcc act tat aac gcc gca ggt cag acc aac	4992
Ser Lys Lys Ala Leu Leu Ala Thr Tyr Asn Ala Ala Gly Gln Thr Asn	
1650 1655 1660	
tat ttg acc aac aac ccc gca gaa gcc att gac aga ata aat gaa caa	5040
Tyr Leu Thr Asn Asn Pro Ala Glu Ala Ile Asp Arg Ile Asn Glu Gln	
1665 1670 1675 1680	
ggt atc cgc ttc ttc cat gtc aac gat ggc aat caa gag cct gtg gta	5088
Gly Ile Arg Phe Phe His Val Asn Asp Gly Asn Gln Glu Pro Val Val	
1685 1690 1695	
caa ggg cgt aac ggc att gac tca agt gcc tca ggc aag cac tca gtg	5136
Gln Gly Arg Asn Gly Ile Asp Ser Ser Ala Ser Gly Lys His Ser Val	
1700 1705 1710	
gcg ata ggt ttc cag gcc aag gca gat ggt gaa gcc gcc gtt gcc ata	5184
Ala Ile Gly Phe Gln Ala Lys Ala Asp Gly Glu Ala Ala Val Ala Ile	
1715 1720 1725	
ggc aga caa acc caa gca ggc aac caa tcc atc gcc atc ggt gat aac	5232
Gly Arg Gln Thr Gln Ala Gly Asn Gln Ser Ile Ala Ile Gly Asp Asn	
1730 1735 1740	
gca caa gcc acg ggc gat caa tcc atc gcc atc ggt aca ggc aat gtg	5280
Ala Gln Ala Thr Gly Asp Gln Ser Ile Ala Ile Gly Thr Gly Asn Val	
1745 1750 1755 1760	
gta gca ggt aag cac tct ggt gcc atc ggc gac cca agc act gtt aag	5328
Val Ala Gly Lys His Ser Gly Ala Ile Gly Asp Pro Ser Thr Val Lys	
1765 1770 1775	
gct gat aac agt tac agt gtg ggt aat aac aac cag ttt acc gat gcc	5376
Ala Asp Asn Ser Tyr Ser Val Gly Asn Asn Asn Gln Phe Thr Asp Ala	
1780 1785 1790	
act caa acc gat gtc ttt ggt gtg ggc aat aac atc acc gtg acc gaa	5424
Thr Gln Thr Asp Val Phe Gly Val Gly Asn Asn Ile Thr Val Thr Glu	
1795 1800 1805	
agt aac tcg gtt gcc tta ggt tca aac tct gcc atc agt gca ggc aca	5472

Ser Asn Ser Val Ala Leu Gly Ser Asn Ser Ala Ile Ser Ala Gly Thr	
1810 1815 1820	
cac gca ggc aca caa gcc aaa aaa tct gac ggc aca gca ggt aca acc	5520
His Ala Gly Thr Gln Ala Lys Lys Ser Asp Gly Thr Ala Gly Thr Thr	
1825 1830 1835 1840	
acc aca gca ggt gca acc ggt acg gtt aaa ggc ttt gct gga caa acg	5568
Thr Thr Ala Gly Ala Thr Gly Thr Val Lys Gly Phe Ala Gly Gln Thr	
1845 1850 1855	
gcg gtt ggt gcg gtc tcc gtg ggt gcc tca ggt gct gaa cgc cgt atc	5616
Ala Val Gly Ala Val Ser Val Gly Ala Ser Gly Ala Glu Arg Arg Ile	
1860 1865 1870	
caa aat gtg gca gca ggt gag gtc agt gcc acc agc acc gat gcg gtc	5664
Gln Asn Val Ala Ala Gly Glu Val Ser Ala Thr Ser Thr Asp Ala Val	
1875 1880 1885	
aat ggt agc cag ttg tac aaa gcc acc caa agc att gcc aac gca acc	5712
Asn Gly Ser Gln Leu Tyr Lys Ala Thr Gln Ser Ile Ala Asn Ala Thr	
1890 1895 1900	
aat gag ctt gac cat cgt atc cac caa aac gaa aat aag gcc aat gca	5760
Asn Glu Leu Asp His Arg Ile His Gln Asn Glu Asn Lys Ala Asn Ala	
1905 1910 1915 1920	
ggg att tca tca gcg atg gcg atg gcg tcc atg cca caa gcc tac att	5808
Gly Ile Ser Ser Ala Met Ala Met Ala Ser Met Pro Gln Ala Tyr Ile	
1925 1930 1935	
cct ggc aga tcc atg gtt acc ggg ggt att gcc acc cac aac ggt caa	5856
Pro Gly Arg Ser Met Val Thr Gly Gly Ile Ala Thr His Asn Gly Gln	
1940 1945 1950	
ggt gcg gtg gca gtg gga ctg tcg aag ctg tcg gat aat ggt caa tgg	5904
Gly Ala Val Ala Val Gly Leu Ser Lys Leu Ser Asp Asn Gly Gln Trp	
1955 1960 1965	
gta ttt aaa atc aat ggt tca gcc gat acc caa ggc cat gta ggg gcg	5952
Val Phe Lys Ile Asn Gly Ser Ala Asp Thr Gln Gly His Val Gly Ala	
1970 1975 1980	
gca gtt ggt gca ggt ttt cac ttt taagccataa atcgcaagat tttacttaaa	6006
Ala Val Gly Ala Gly Phe His Phe	
1985 1990	
aatcaatctc accatagttg tataaaacag catcagcatc agtcatatta ctgatgctga	6066
tgttttttat cacttaaacc attttaccgc tcaagtgatt ctctttcacc atgaccaa	6126
cgccattgat cataggtaaa cttattgagt aaattttatc aatgtagttg ttagatatgg	6186
ttaaaattgt gccattgacc aaaaaatgac cgatttatcc cgaaaatttc tgattatgat	6246
ccgttgacct gca	6259

05351519 "072299

Figure 9A Construction of pKS294

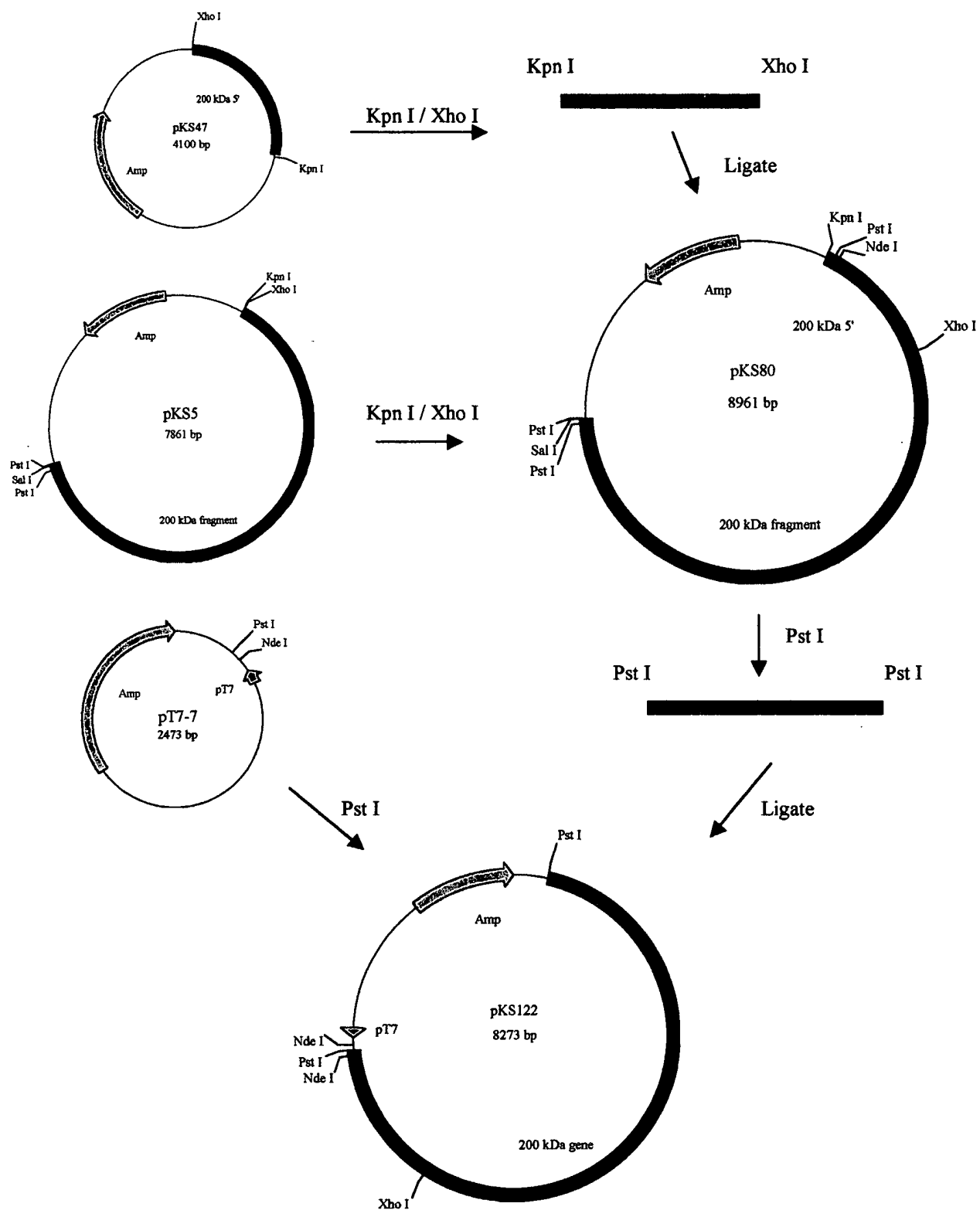
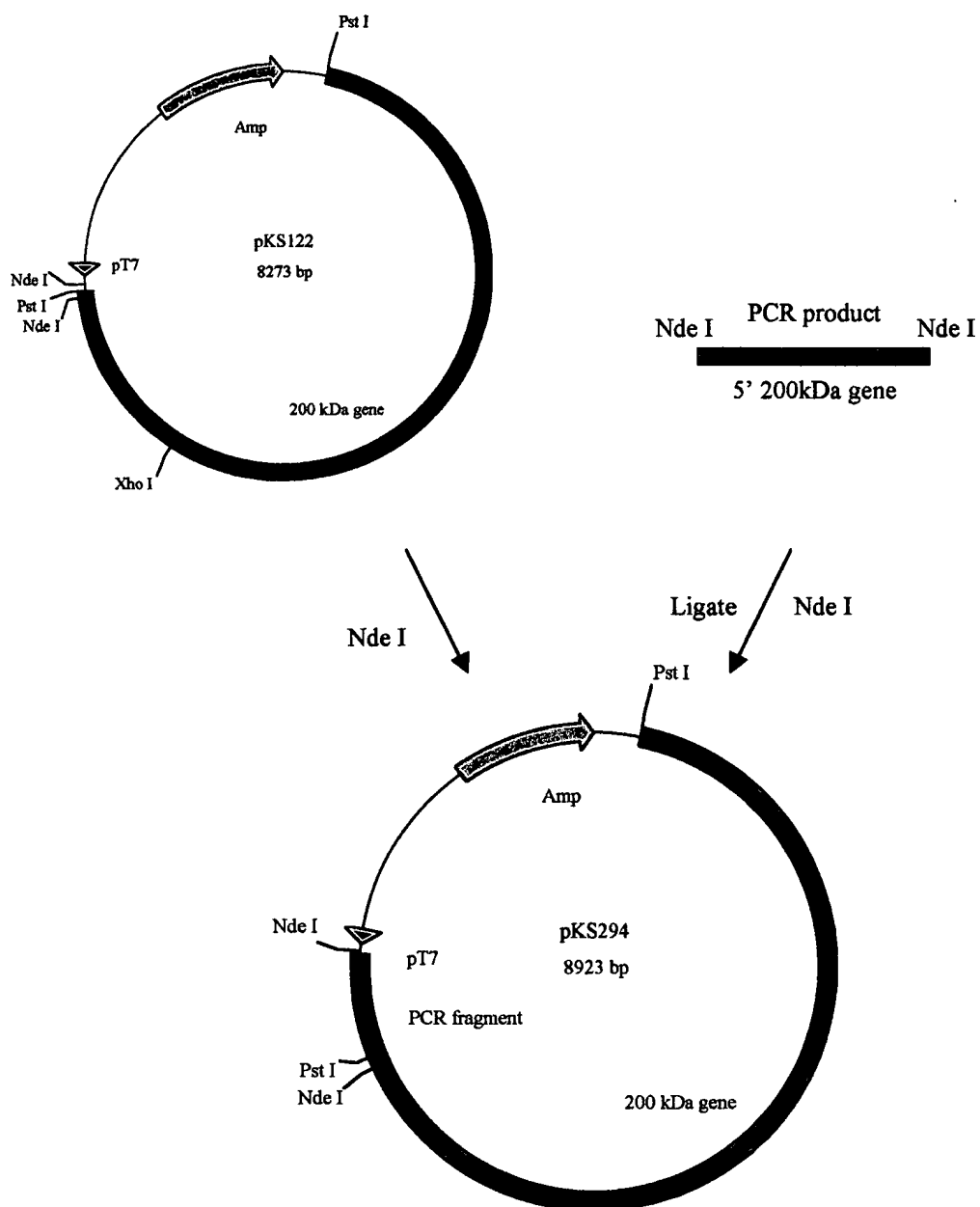
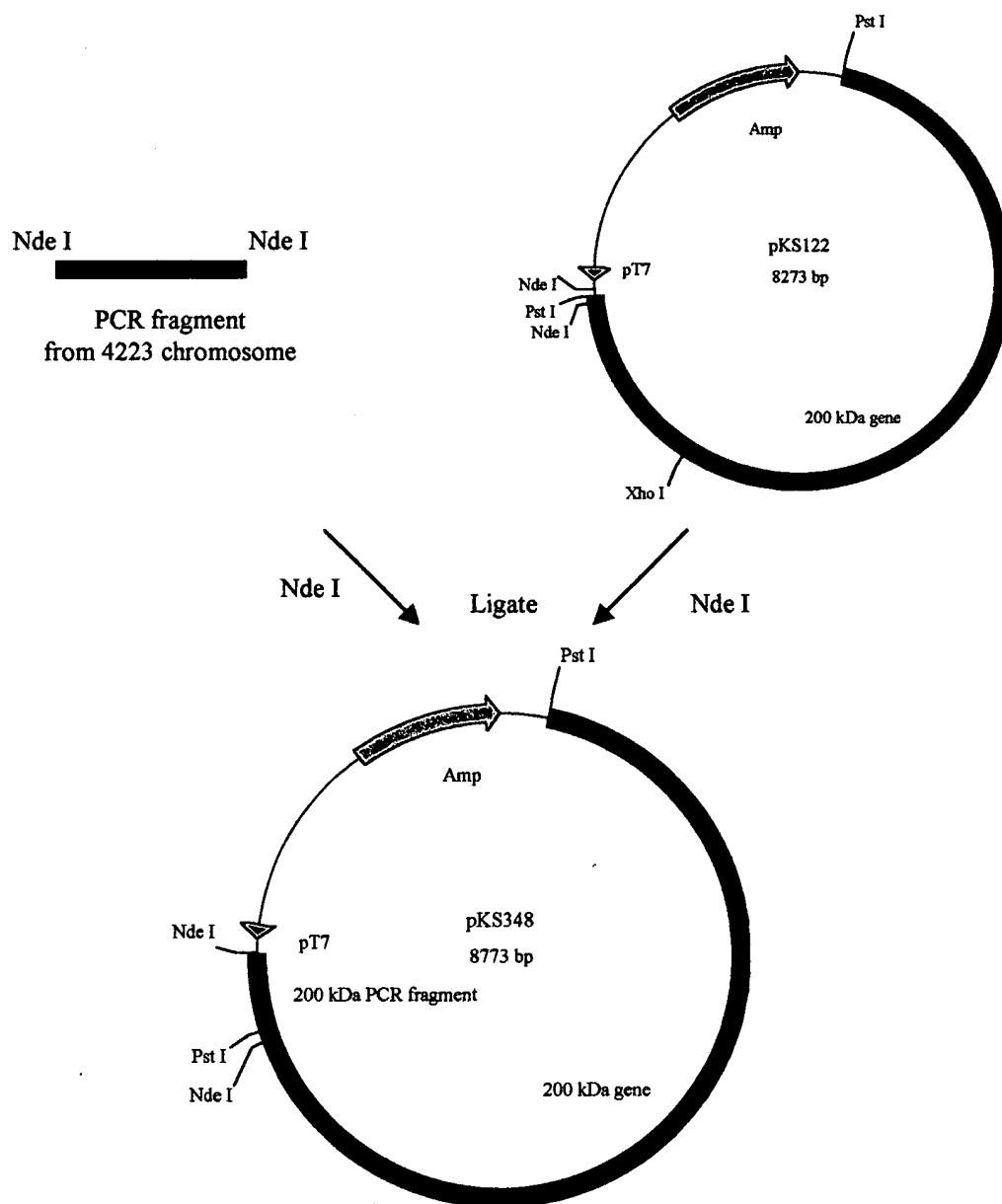


Figure 9B Construction of pKS294



09361619-02299

Figure 10. Construction of pKS348

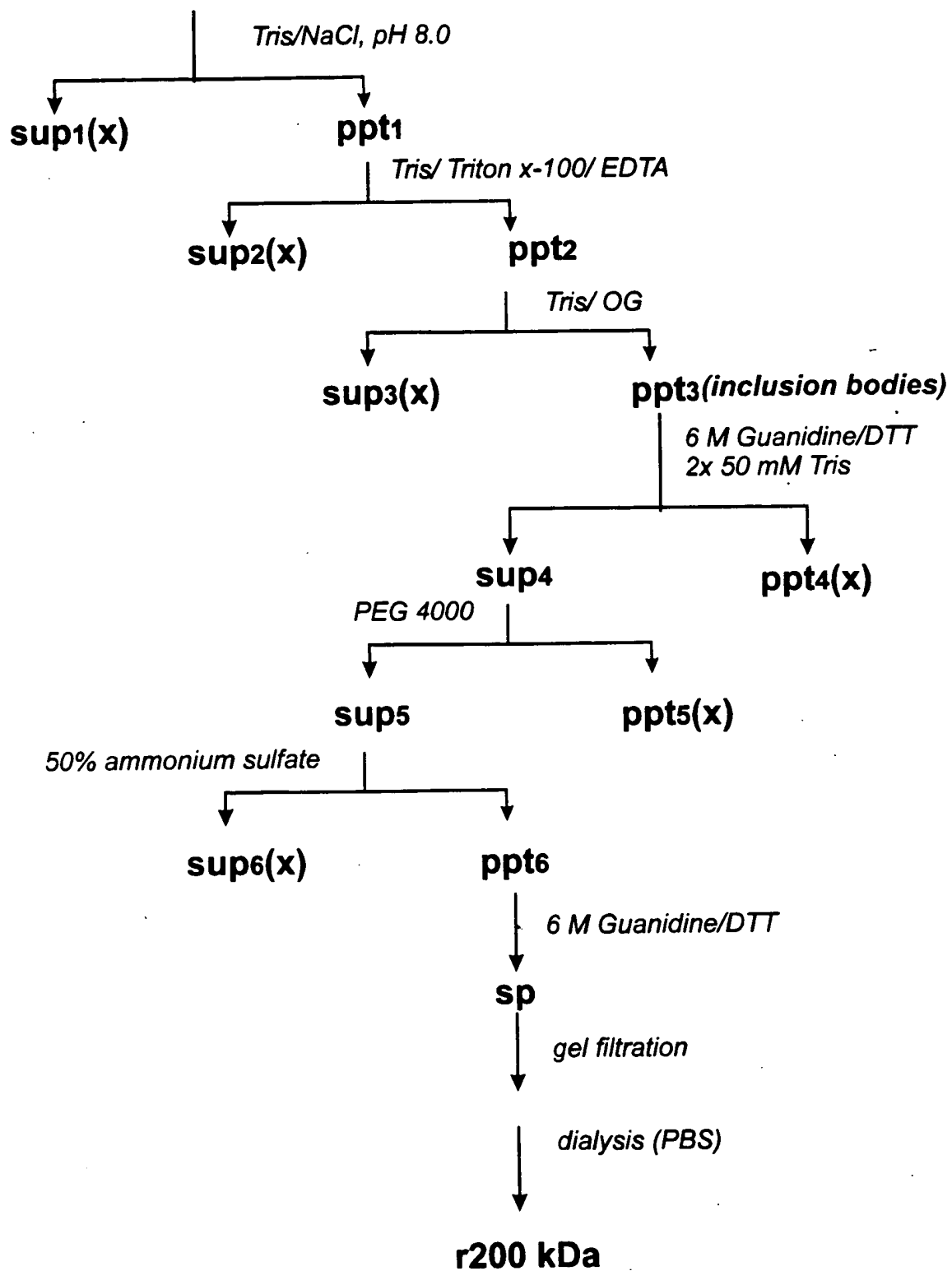


66420-6T9E60

FIGURE 11

Purification of r200 kDa Protein from *E. coli*

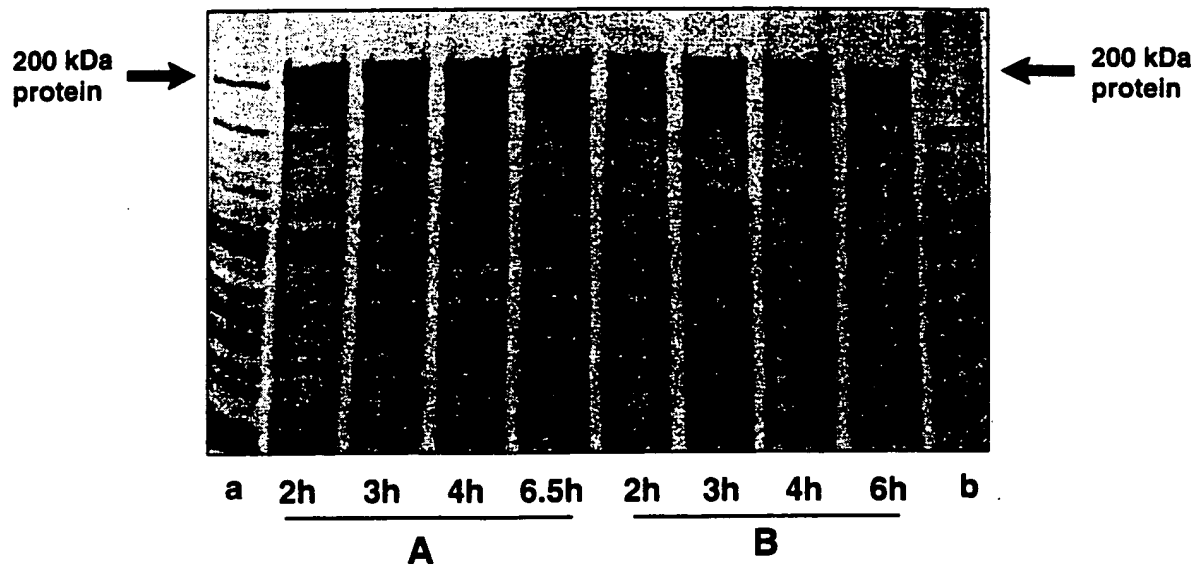
***E. coli* Whole Cell**



09361619.072799

FIGURE 12

Expression of M56 r200 kDa Protein Gene in *E. coli*



A: KS358 induced when O.D. ^{Vat}600 nm was 0.26

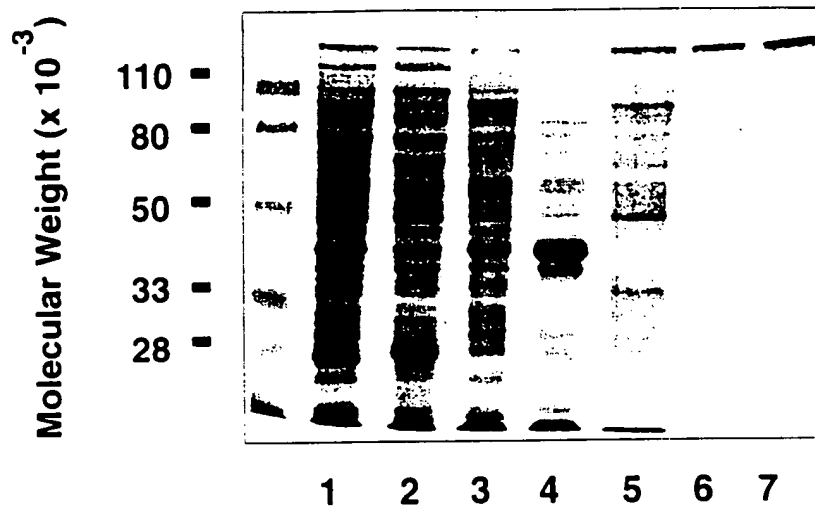
B: KS358 induced when O.D. at 600 nm was 0.44

a: strain 4223 lysate

b: KS358 cultured overnight

FIGURE 13

Purification of M56 r200 kDa Protein (4223)



1. *E. coli* Whole cells
2. Soluble proteins after 50 mM Tris/ NaCl, pH 8, extraction
3. Soluble proteins after Tris/ Triton X-100/ EDTA extraction
4. Soluble proteins after Tris/ OG extraction
5. Pellet after Tris/ OG extraction
- 6-7. Purified 200 kDa protein

Anti-M56 r200 kDa Antibody Titers in Mice



662320-6T9T9E60

FIGURE 15

Anti-M56 r200 kDa Antibody Titers in Guinea Pigs

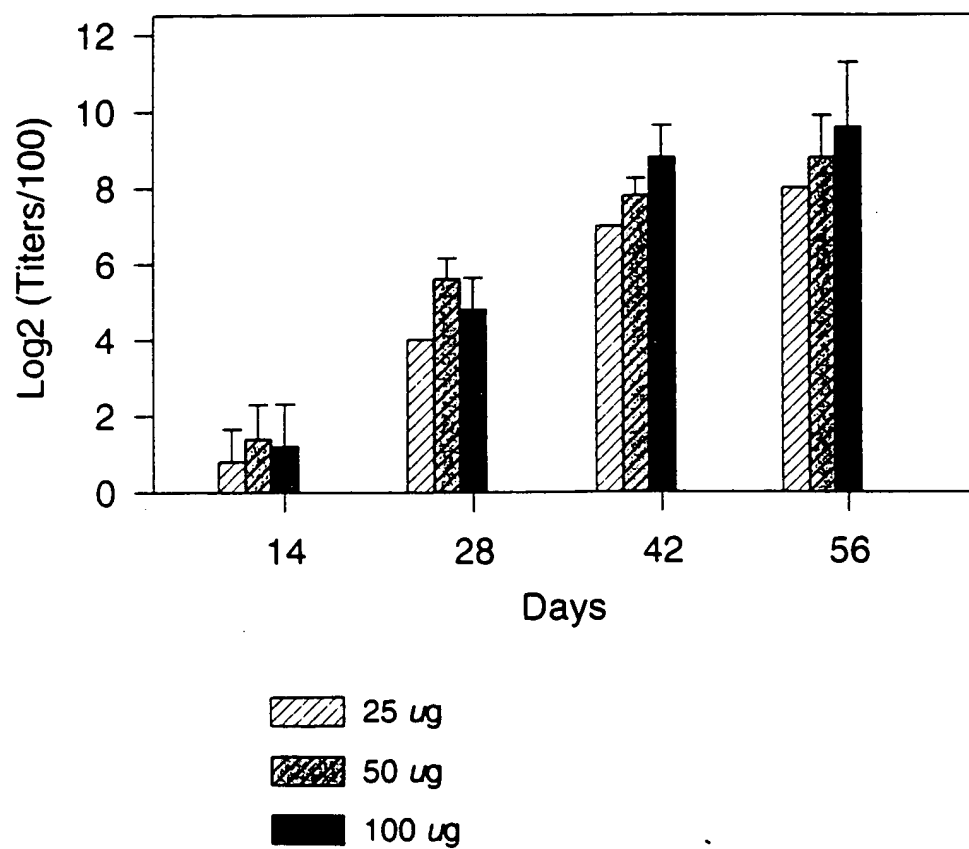


FIGURE 16

PCR amplification of DNA fragments carrying a portion of the
200 kDa protein gene from chromosomal DNA of RH408

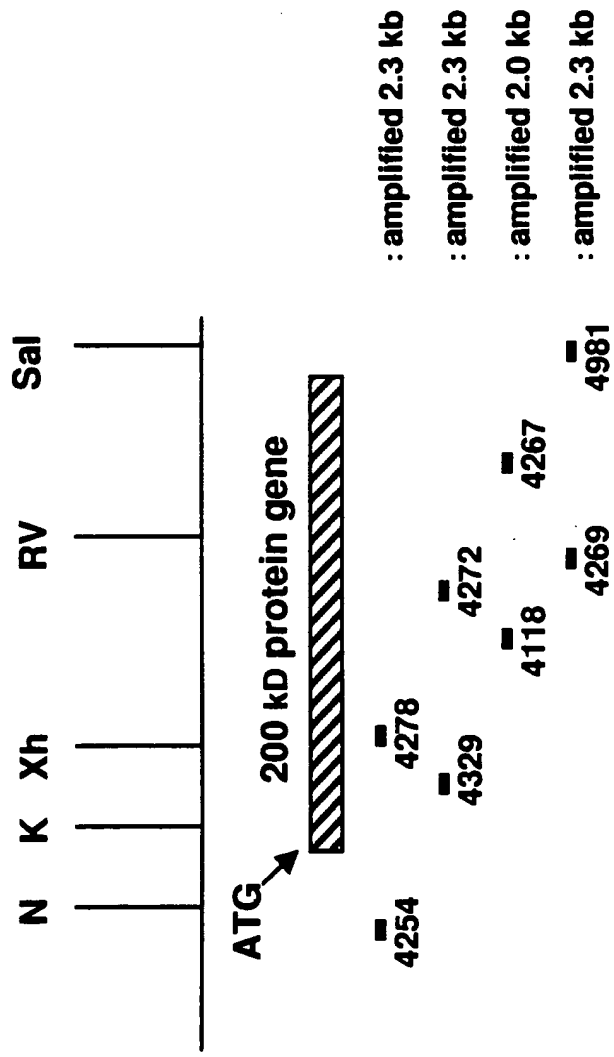


Figure 17

M. catarrhalis strain 4223 200 kDa

CCATGGATATGGGCAGGTGTGCTCGCCTGCCGTATGATGGCGATGACACCCCATTTGCCC
10 20 30 40 50 60

CATATCTGTACGATTTGACATGTGATATGATTTAACATGTGACATGATTTAACATTGTTT
70 80 90 100 110 120

AATACTGTTGCCATCATTACCATAATTTAGTAACGCATTTAGTAACGCATTTGTAAAAAT
130 140 150 160 170 180

CATTGCGCCCCCTTTATGTGTATCATATGAATAGAATATTATGATTGTATCTGATTATTGT
190 200 210 220 230 240

ATCAGAATGGTGATGCTATATGATGATGCCTACGAGTTGATTTGGGTTAATCACTCTATG
250 260 270 280 290 300

ATTTGATATATTTTGAACTAATCTATTGACTTAAATCACCATATGGTTATAATTTAGCA
310 320 330 340 350 360

TAATGGTAGGCTTTTTGTAAAAATCACATCGCAATATTGTTCTACTGTTACTACCATGCT
370 380 390 400 410 420

TGAATGACGATCCCAATCACCAGATTCATTCAAGTGATGTGTTTGTATACGCACCATTTA
430 440 450 460 470 480

CCCTAATTATTTCAATCAAATGCCTATGTCAGCATGTATCATTTTTTTAAGGTAAACCAC
490 500 510 520 530 540

MET ASN HIS ILE TYR LYS VAL ILE PHE ASN LYS ALA¹² THR GLY THR PHE MET ALA VAL¹⁹ ALA
CATGAATCACATCTATAAAGTCATCTTTAACAAAGCCACAGGCACATTTATGGCAGTGGC
550 560 570 580 590 600

GLU TYR ALA LYS SER HIS SER THR GLY GLY GLY SER CYS ALA THR GLY GLN VAL GLY³⁹ SER
AGAGTACGCCAAATCCACAGCACGGGGGGGGTAGCTGTGCTACAGGGCAAGTTGGCAG
610 620 630 640 650 660

VAL CYS THR LEU SER PHE ALA ARG ILE ALA ALA LEU ALA VAL LEU VAL⁵⁶ ILE GLY ALA THR
TGTATGCACTCTGAGCTTTGCCCGTATTGCCGCGCTCGCTGTCCTCGTGATCGGTGCAAC
670 680 690 700 710 720

05361619-07999

FIGURE 18
3' Half Constructs of 200 kD Protein Gene

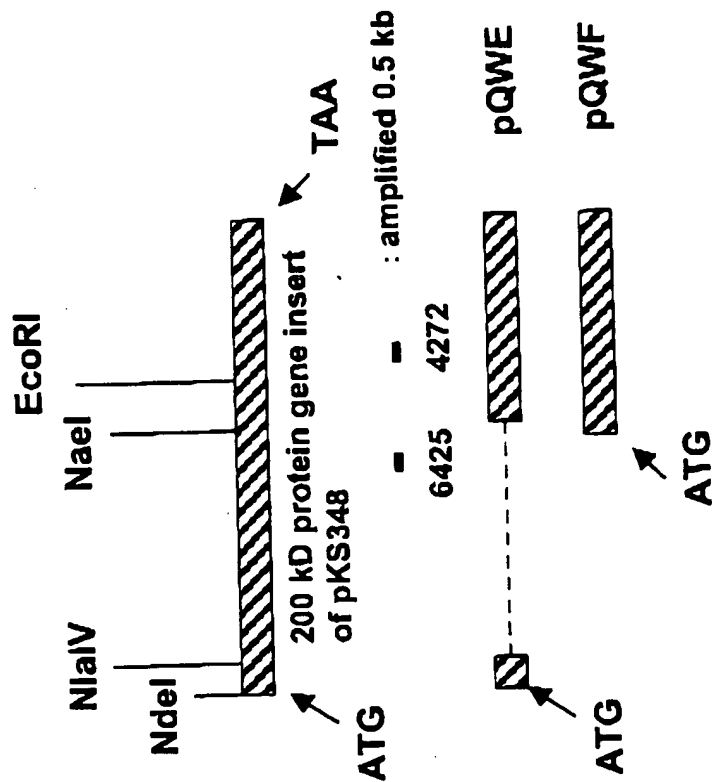
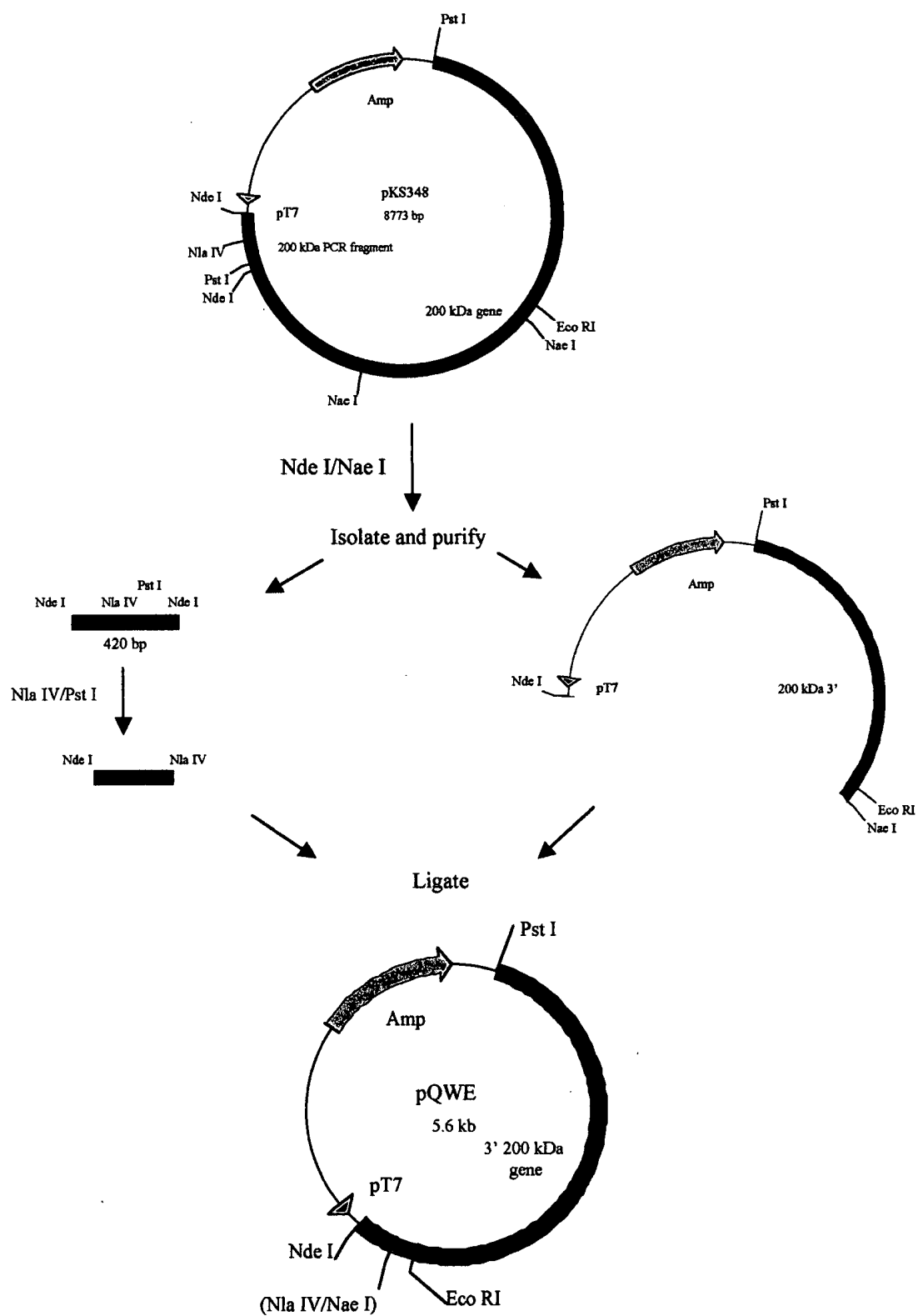
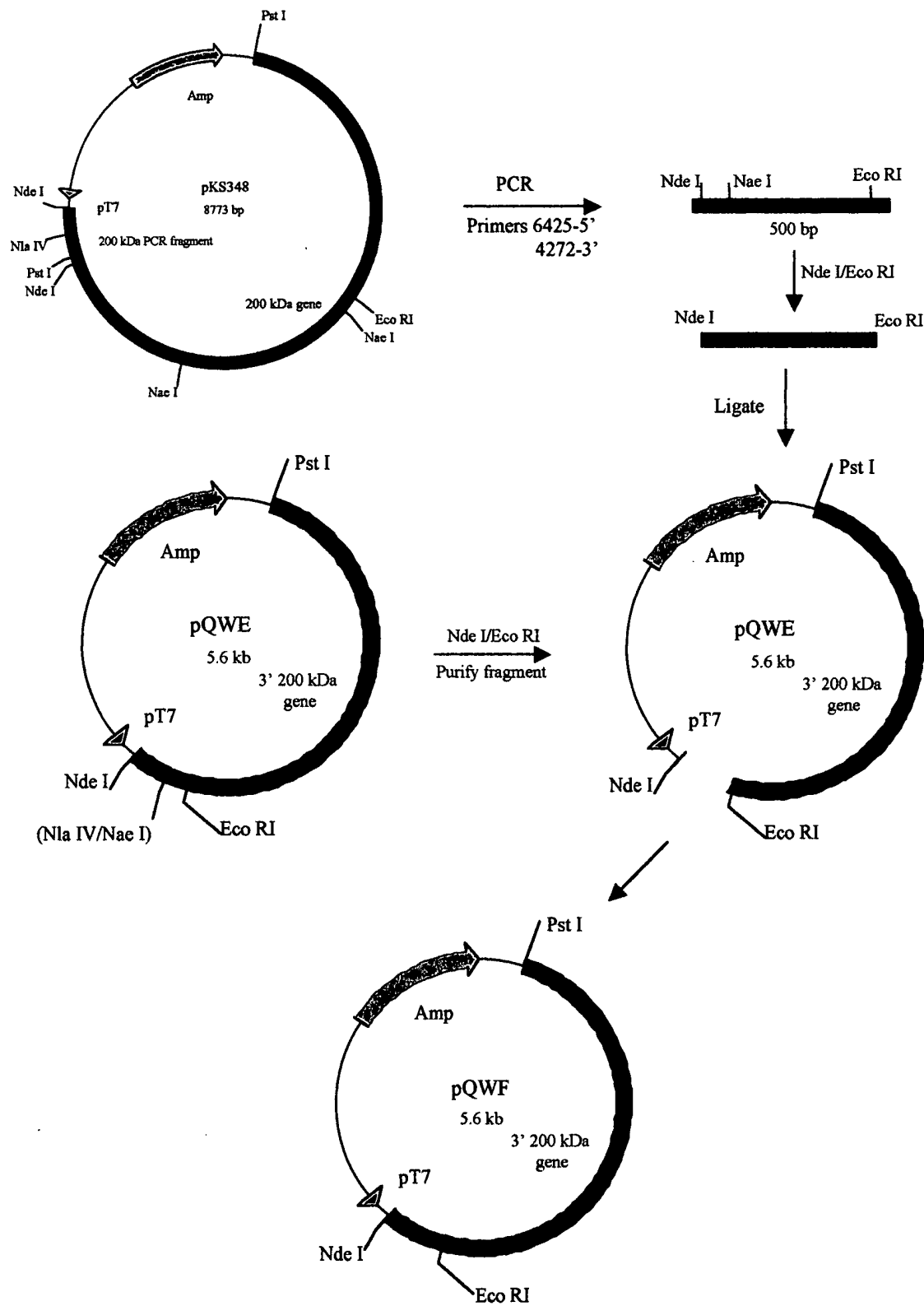


Figure 19 Construction of pQWE



66220-6T9660

Figure 20 ' Construction of pQWF



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